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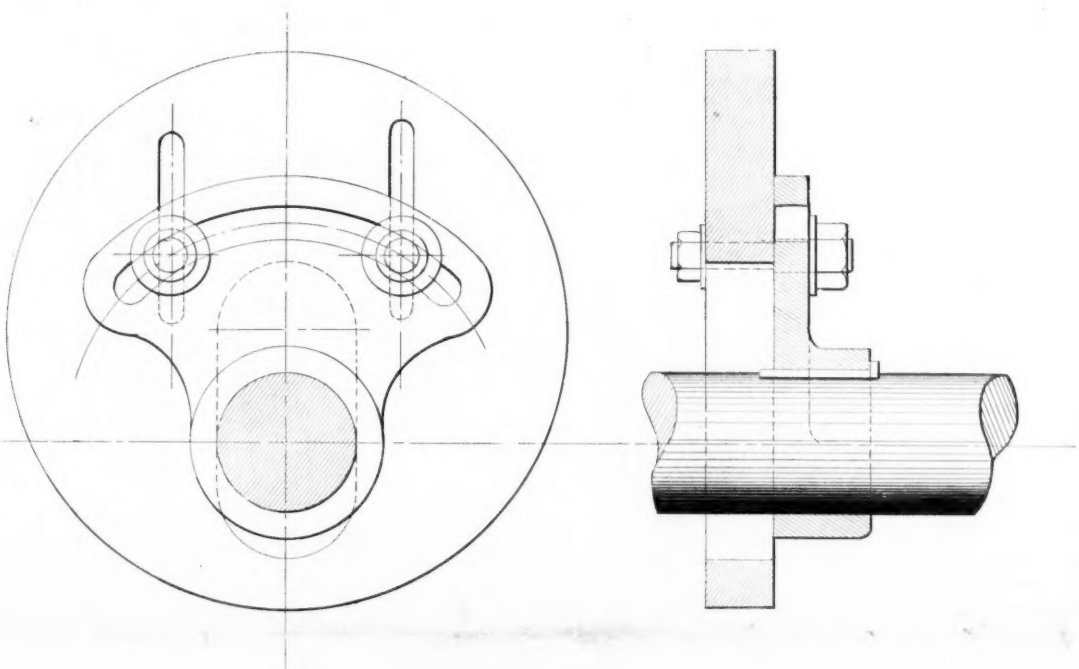
Adjustable Eccentric.

The accompanying cut gives two views of an adjustable eccentric, suitable for a link motion model. The cut shows the device so clearly that no detailed description is necessary. It was invented by Mr. L. Wichert, who is with Mr. Harrington, chief draftsman in the drawing office of the Pittsburgh, Cincinnati & St. Louis Railway at Columbus, O. It is the intention to apply this eccentric on a new link motion model they are getting up.



ADJUSTABLE ECCENTRIC.

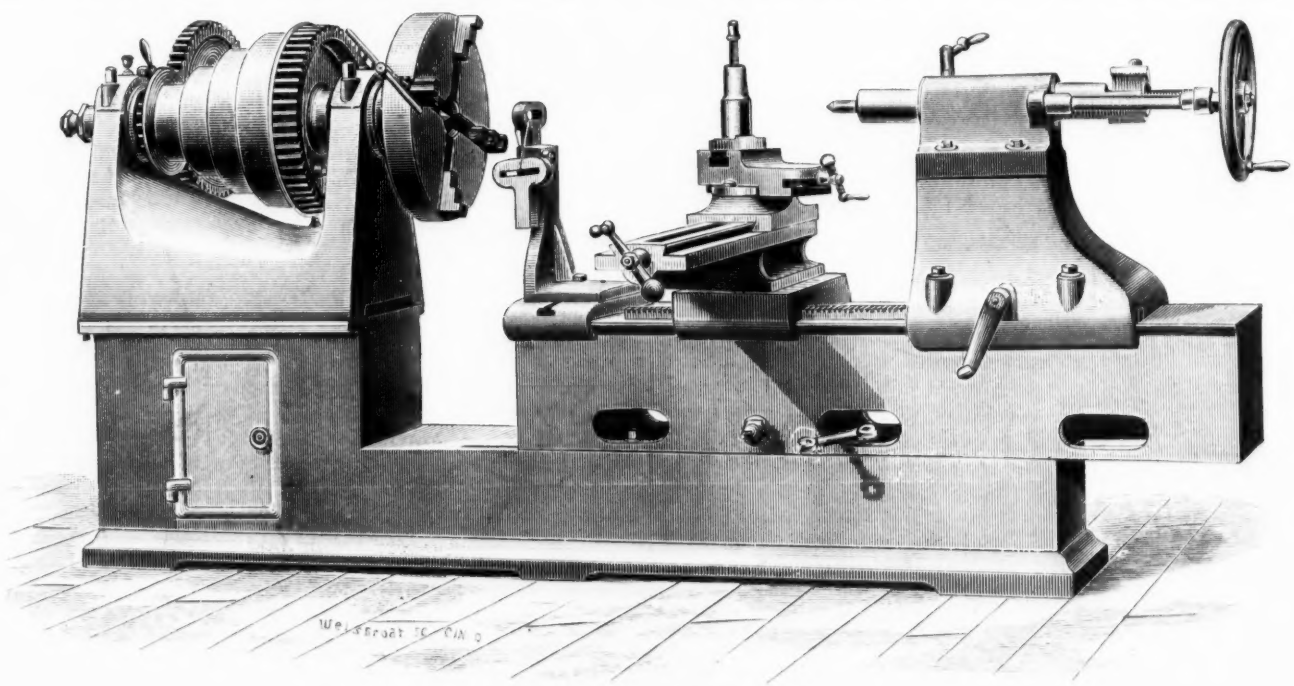
The war cloud in Europe does not throw any shadows upon our soil. A Pittsburgh rolling mill is working on a large order for armor plates for the Russian navy. A Bridgeport cartridge factory is working to fill a large order for cartridges for England, and one twice as large for Russia. Two or three Chicago firms have orders each for several million pounds of pressed beef for the English government. A Brooklyn steam pump works has already supplied the British government with a number of pumping engines to be used in the Soudan, and is ready to supply them as many more, if they want them, for use in the desert of Afghanistan. Both the Russians and the British know they can procure the best kind of war supplies from the United States. Let them send along their orders.

Sixty-Inch Gap Chucking Lathe

The engraving herewith presented represents a new 60-inch chucking lathe, manufactured by Lodge, Barker & Co., Cincinnati, Ohio.

This machine, with gap open, swings 60 inches, and with gap closed swings 36 inches. The gap opens to leave space of 4 feet.

The slide rest is compound, to bore or turn straight and taper, and will face up the entire 60 inches. Largest diameter of cone is 18 inches, and is geared 10 to 1. The front bearing is $4\frac{1}{4}$ inches diameter by 6 inches long. The tail spindle is $3\frac{1}{4}$ inches in diameter, and has quick return motion. Tight and loose pulleys on countershaft 18 inches in diameter with 5-inch face, and should run 60 revolutions per minute. This lathe can be made with turret-head instead of tail-stock, and power feed will be furnished if desired.



SIXTY-INCH GAP CHUCKING LATHE.

"On Steel Hardened by Pressure."

BY S. W. GOODYEAR.

Having once before—possibly through the temerity born of ignorance—taken exception through your columns to the statements at that time going the rounds of the scientific journals, that "pressure, as such, hardened steel," and finding that the same doctrine, with some modifications and explanations, is again being forced upon the notice of the public, I beg your indulgence while I endeavor to point out as a mechanic, disclaiming all knowledge on the subject as a scientist or expert, what there is in this system, as proven by actual practice, as well as indicated by the attempted explanation of its advocates.

The term "hardening," in its fullest sense, implies a change from a condition in which steel can be cut and worked, even bent, *cold*, to a condition of hardness precluding the possibility of cutting, or bending to the slightest degree without breaking. From this extreme degree of hardness of which, in shop parlance it is said, "so hard that the best file won't touch it," there are different degrees down to where a file will mark, then cut, with extreme care exercised in shoving the file slowly, and finally, where with bold stroke, the file "cuts it like cheese," or it can be bent double even, without danger of breaking.

In carbon steel, the extreme condition of hardness is, without doubt, produced by sudden cooling from the proper condition of heat. That many of the intermediate conditions of hardness to be found between thoroughly hardened steel, and steel in an annealed condition, do exist, after the operation of hardening, *i. e.*, heating and suddenly cooling have been performed, must be charged to differences in carbon in different steels, different heats, different character and temperature of quenching material, in a word, adaptability of steel under treatment to harden, with sudden cooling from the proper heat, must be had, or some intermediate degree of hardness will result.

"Why steel hardens?" may be an unanswerable question.

"What hardens steel?" is easily answered, and that the heat is rapidly conducted from a piece of steel, heated to the proper heat for hardening, by being "compressed as speedily as possible between metallic plates in a hydraulic press, care being taken that the plates are good heat conductors," thereby hardening the pieces, is an illustration of one method of sudden cooling, which hardens steel, but, as pressure is applied, that force must have full credit for the resultant hardening, and we have, forsooth, "hardening by pressure," when, without the sudden cooling, with twice the amount of pressure applied, and removed before the heat had been conducted away down to the hardening point, there would have been no hardening.

Why not call things by their right names? If pressure, as described, has a beneficial effect on steel—and it is easy to believe that it may have—why not describe the advantages known to exist, and speculate upon imaginary ones, without attempting to ignore the natural law under which steel hardens? *Sudden cooling hardens steel.* When steel is hardened under pressure, there would be about the same ground for a claim on the part of "pressure" to having done the job, that a fly would have, which should cling to the felly of a wheel on a stage coach, to making the wheel go around.

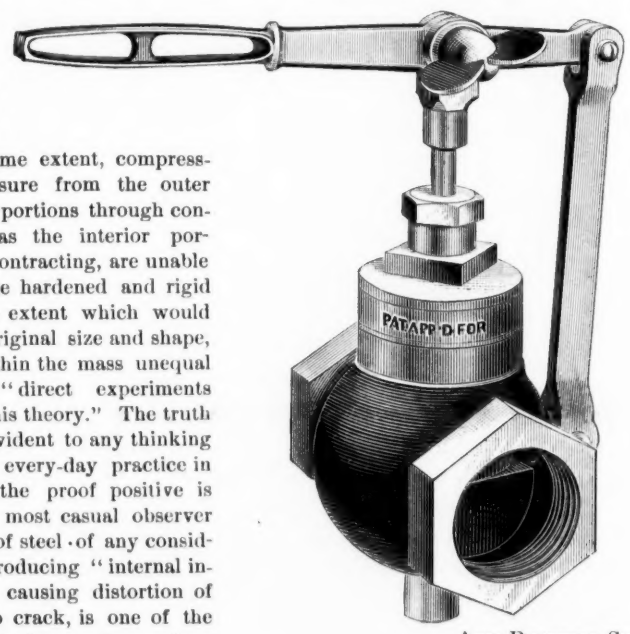
That steel, heated to a "cherry-red heat, placed between metallic plates—good heat conductors—under a hydraulic press, submitted to pressure and allowed to cool in the press, will acquire new qualities, and be much finer grained and considerably harder and tougher than ordinary steel slowly

cooled in the air without pressure," is true. What of it? There is nothing here to base the claim of "hardening by pressure" upon, and further, the same quality of steel coming from the heating furnace at the same heat used for the "by pressure" process, can, by working under the hammer, or between rolls down to a low heat, be made "finer-grained, harder and tougher" than if allowed to cool off slowly without the working, or than if the hammering or rolling should cease while there was still remaining a high degree of heat.

"The cooling of the steel must be very rapid between the plates of the hydraulic press." Yes, if hardening results it must.

"Hot hammering and rolling last but a short time. . . . The effect of the hydraulic pressure must be quite dissimilar." Yes, if the piece continues under pressure till cold in the one case, and is left to "cool in the air" from a high red or yellow heat in the other, but, if each shall receive the work, blow or rolling on the one hand, and pressure on the other, and the piece be removed from the press at such a heat that both may cool in the air from the same heat, then what?

That a piece of steel of any considerable size, when heated to the proper heat for hardening, and either plunged in water, or placed under pressure between metallic plates under a hydraulic press, will by the sudden cooling of the outer portion—"exterior strata"—first assume the condition of an interiorly expanded, and to some extent, compressible mass, under pressure from the outer and suddenly cooled portions through contraction, and that, as the interior portions cooling later in contracting, are unable to draw after them the hardened and rigid outer portion to that extent which would fully return it to its original size and shape, thereby setting up within the mass unequal tensions, needs no "direct experiments proving the truth of this theory." The truth of the theory is self-evident to any thinking mind, while through every-day practice in thousands of cases, the proof positive is forced upon even the most casual observer that to harden pieces of steel of any considerable size without producing "internal inequality of tension," causing distortion of shape, with liability to crack, is one of the most difficult operations known to mechanics.



Anti-Pressure Steam and Water Valve.

It is probable that pressure applied to two opposite sides of a heated piece of steel by two plates under a hydraulic press would result in leaving the two sides in contact with the "good heat conducting metallic plates" more nearly of the original shape, and the depth in the direction of the pressure more nearly what it was before heating than if the cooling should be accomplished by plunging in water or other quenching liquid; but, while conceding this, would not the assumption be justifiable, that on general principles the other surfaces not under pressure would be liable to greater distortion in consequence of the protection to top and bottom by pressure?

If this assumption is said to be false, judged by the condition of pieces of steel, "hardened by pressure" as compared with other pieces of the same quality, size and shape, hardened by liquid quenching, then it is fair to retort that one process *hardens*, the other but *partially* hardens. The sudden cooling all over in water hardens and converts the outer portion into an unyielding box which cannot get back to original size and shape while the interior is largely expanded by heat, nor from its unyielding character can it get back after the contraction by cooling has taken place in the interior, while just in proportion as the heat is conducted away more gradually, and the degree of hardness and rigidity produced is less in the so-called "pressure hardening" than by the quenching process, there will be less distortion, less "internal inequality of tension" and liability to crack, but, under the universal law of compensation there will be less of what the operation was expected to produce, *i. e.*, hardness, and if the degree of hardness produced by the "pressure" process could be accurately gauged, and the lower heat used, which would produce the same condition by quenching in water, or, using the same heat as in the "pressure" method, cooling in some greasy or heated quenching compound, whereby the heat will be conducted away no more quickly than by the plates in the hydraulic press, is there not good ground for believing that the advantage claimed for the "pressure" plan would show up very small?

Suppose that the metallic plates between which the heated piece of steel is to be pressed under the hydraulic press, were to be heated to a good red heat themselves, and the same pressure applied, who believes that the steel between the heated plates would be hardened?

If pressure hardens, why should it not?

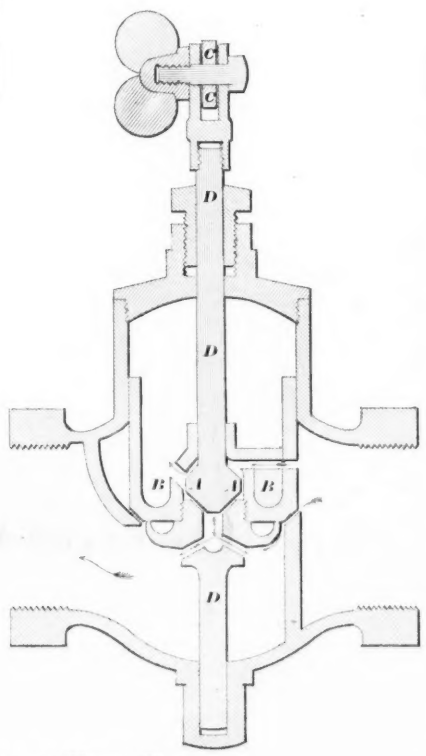
If, in hardening a piece of steel by pressure, the peculiar condition of grain produced by hardening at the right heat should be manifest in the "external strata," who believes that it will extend clear through the piece, or that the piece will be hardened any more deeply than if it had been quenched in water? If pressure hardens and refines, why not clear through?

That steel depends for its fineness of grain upon "a tightening of the steel molecules while they are yet soft enough to weld together," and that through this welding together comes a great increase of strength, is interesting, but what is there new in it? Steel is worked under the hammer and between rolls ostensibly to bring it to size and shape required, but not less to produce the molecular condition required for the uses to which it is to be put. A condition of great tenacity and fineness of grain depends largely upon how the work is performed, whether—if hammering is resorted to—but a small section of surface shall be affected by each blow, thereby stretching the metal on the principle of peening; or, whether a considerable surface shall be acted upon; whether in hammering squares, rounds, or other shapes adapted to swaging, swages shall be used, thereby forcing all parts of the metal upon itself, and from all directions toward the center, or whether the hammering shall be done between two plain, flat surfaces, as between hammer and anvil, giving the metal chance to escape from the full effect of the blow; whether the working begins with the steel at just the right heat for beginning, and ceases at just the right heat to produce the best results, with a multitude of other questions which might be raised, have a bearing on the subject; but, unless the advocates of "hardening by pressure" are willing to concede that steel can be welded cold as well as hot, what becomes of their theory that by their plan "welding together of molecules," deserves full credit for increase of strength and superior fineness of grain, when cold working, as rolling, drawing, and swaging are known to produce a great increase of strength, and to change steel of a very coarse grain, even the grain to be found in the ingot, to a condition of exceeding fineness?

With cold-drawn steel wire showing a tensible strength of 160,000 pounds to the square inch, when the rods from which it was drawn as they come from the rolls would show but little, if any, over 100,000 pounds, and in the annealed condition, as prepared for drawing, not more than 80,000 pounds, while from a coarse condition of grain the drawing has produced a grain too fine to be discernible to the naked eye, why should we have our attention called to similar conditions produced by placing under pressure when hot, permitting to remain under pressure until cold, and be asked to believe that welding has taken place? What is welding? Is it not the intermingling of the molecules when heated to a condition of semi-fusion or plasticity? In spite of the claims for "cherry-red welding compounds" who believes that steel welds at the cherry-red heat at which steel should be hardened, whether under pressure or otherwise? As to the claim that "steel hardened in water shows increase in volume and decrease in specific gravity," there are strong grounds for denying the universal application of this rule. That steel which is hardened at too great heat, thereby opening the grain, and producing, as is often the case, a grain as coarse as pig-iron will show a decrease of specific gravity is readily believed. That suddenly cooling a piece from a heat much greater than is necessary to produce the hardness required should produce the same effect, is reasonable; but, suppose the heat had been not too great, or the cooling had been sufficiently slow to permit contraction in the natural way which sudden cooling obstructs, then what? Will somebody who has made a thorough test of the matter by hardening pieces of steel of such size as will harden clear through at just the heat to refine by hardening, tell us what they know about the matter? Under the conditions stated, will there not be a plain contradiction of the statement quoted from the "pressure hardening" advocate?

That "M. Clemandot's invention is worthy of investigation," I am very willing to concede. That its merit may be even greater than has been claimed, I feel no disposition to dispute, but I believe that its advocates have been unfortunate in their description of what it really is, and does, thereby putting before the public a "what is it" more puzzling even than that which helped to make the name of P. T. Barnum famous.

If any of your readers know that pressure, as such, does really harden steel, as hardening is generally understood, I hope we shall hear from them.



Anti-Pressure Steam and Water Valve.

In the sectional cut of this valve, *C* represents the handle, *D* the stem, *B* the main valve, and *A* the secondary valve.

The valve operates *with* the pressure, and is perfectly balanced by means of the secondary valve. In operation, the secondary valve is first opened, which gradually takes the pressure from the main valve, leaving nothing but the friction to be overcome. In closing, the secondary valve is first closed, which gradually brings the full pressure on the upper side of main valve, which is exerted to keep the valve closed. Even the largest size can be operated with an exertion scarcely noticeable.

This valve is being put upon the market by Hilborne L. Roosevelt, 317 South 22d Street, Philadelphia, Pa.

A Lady's Reading of a Cross-Section Drawing.

People who undertake to lecture on mechanical subjects to a mixed audience ought to avoid the use of cross-section drawings to illustrate their discourse; or, if they are used, very clear explanations should be given. The writer lectured the other evening on the "Locomotive" to a mixed audience in the Young Men's Christian Association rooms in the Grand Central Depot, New York, and a half-size cross-section of the Underhill locomotive boiler was used to show plainly what a multi-tubular boiler is. The explanations were duly given, and supposed to have been satisfactory. At the finish of the lecture the people were lingering round the room, talking and looking at the illustrations. A lady was examining the Underhill boiler drawing with great attention, and her escort asked what she was looking at. She explained that she was trying to understand the drawing. He asked what she made of it. "It looks to me," she said, "like a square with a great many tracks running from one side of it and a small house on the other side." The fire-box was the square, the tubes were tracks, and she imagined that the dome represented a house.

Correction.

In the article by John Coffin, on the "Balance of Rotary Parts of Machinery" (April 11), the printer, in making up, changed the last line in the inspection of the equation so as to stand T=8....D= $-e$.... 8. It should be T=∞....D=$-e$....8. Just above this the expression $w\ v\ ^2d\ e=\frac{D}{D+e}$ should be $wv^2dc=\frac{D}{D+e}$, and the expression immediately under wv^2dc=T.

Lake Shore Apprentice Shop.

When Mr. Charles Paine was General Superintendent of the Lake Shore & Michigan Southern Railroad, he took an active interest in the organization of an apprentice school connected with the shops of the company at Buffalo. The school has now been in operation some eight years, and its influence for good has been remarkable.

From the Buffalo *Express* we learn the school at the Buffalo shop is in charge of Mr. Matthew Scanlon, who graduated from it, and who is now the draughtsman of the shop here, besides having entire charge of the tools. His experience in the school taught him just what the scholars needed to learn, and the result is that, in order to explain the lessons thoroughly, models are used in addition to the blackboard drawings. The school is now attended by the sixteen apprentices from the blacksmith, tin, boiler, and machine shops, who are obliged to attend the class for two hours on one night each week. A vacation of two months from the lessons is given them in July and August of each year. As a rule, when the boys first enter the school, it seems dull and uninteresting for them, but the many advantages they are given in the way of study, soon make them earnest attendants. The advantage of this instruction is that they can ob-

tain both theoretical and practical education at the same time. During all of the time Mr. Paine was connected with the road he offered a prize of a book on mechanics each year to the boy making the most progress in his class. Master Mechanic, J. S. Graham, and shop foreman, Peter Fowler, are both earnest friends of the school, taking great interest in its progress and furnishing it with all the facilities at their command. No apprentice is allowed to work in the shops unless he attends the draughting school, and a refusal to attend it results in his place being filled by another.

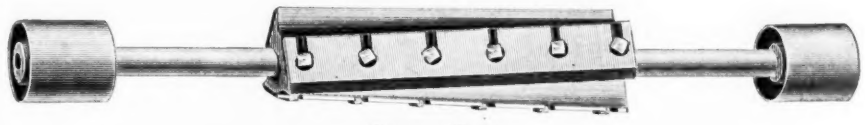
A New Hand Planer.

The large engraving represents a new hand planer, made by Bentel, Margedant & Co., Hamilton, Ohio. It is adapted to planing out of wind, jointing, squaring, smoothing, leveling, cornering, chamfering, tapering and mitering; hand matching can also be done with this machine.

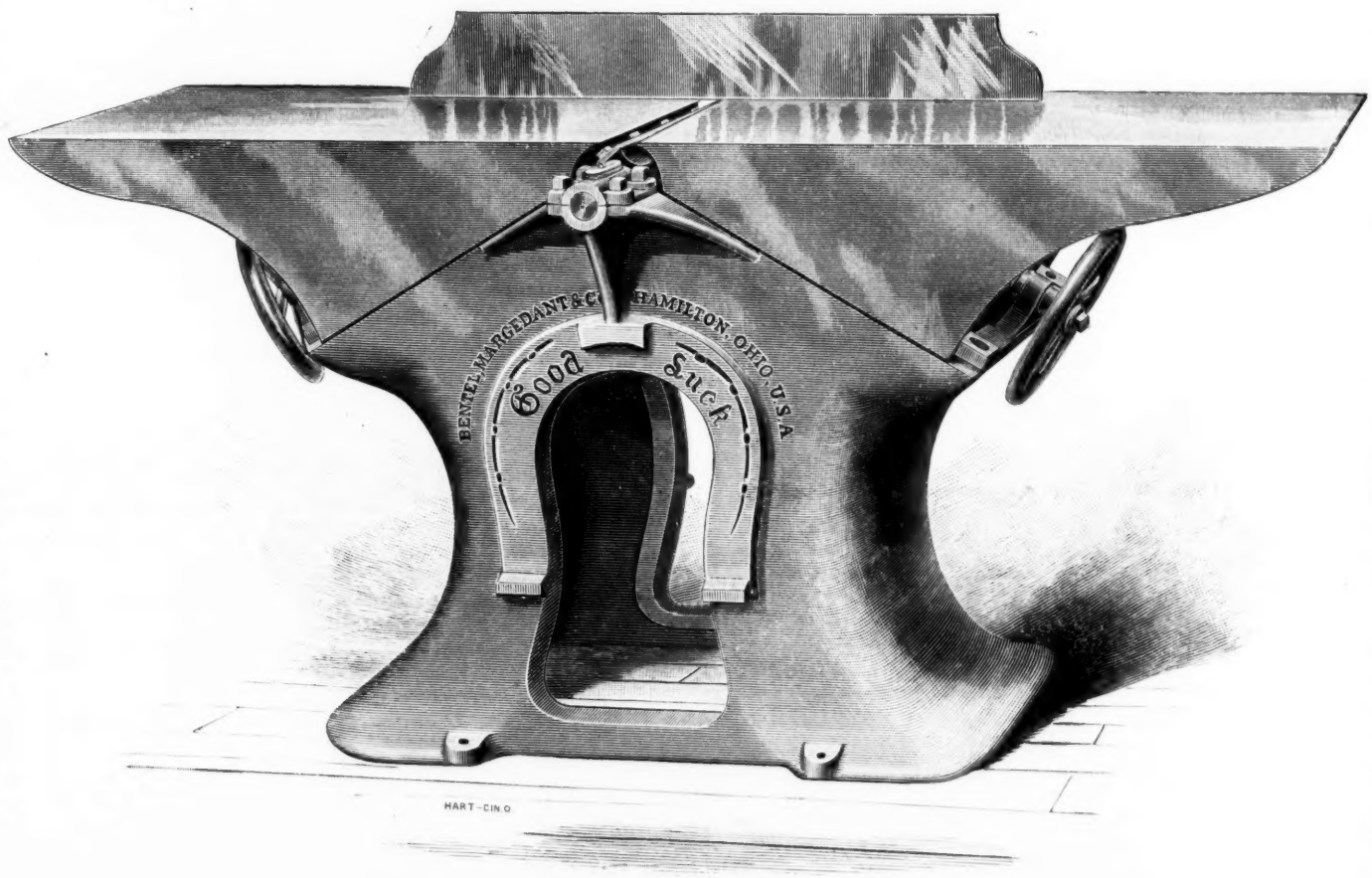
The frame is a solid casting, properly proportioned to support the table and cutter-head. The tables are cast in one piece, each one being 3 feet long, or from end to end, including the opening for the cutter-head 6 feet 2 inches. The tables rest on long slides, and are adjusted for depth of cut by hand wheels conveniently placed.

A fence is provided, which can be set at any angle or bevel, and can be adjusted to any position across the surface of table.

The small cut represents the cutter-head. The knives are straight, but are set on an angle, giving a shearing cut, producing smooth work on cross-grained or knotty wood. These machines are built of 12″, 16″, 20″ and 24″ capacity.



CUTTER HEAD.



A NEW HAND PLANER.

Locomotive Draft Appliances.

BY J. D. CAMPBELL.

The duties that an intervening appliance between the smoke stack and exhaust pipe, or between the flues and the smoke stack of a locomotive, have to perform are often misunderstood and confounded. The first, the lifting pipe between the stack and the short exhaust pipe, has several functions. It acts as a regulator, and distributes the draft equally through the flues. By its distance from the base of the stack and the bottom of the smoke box, and when made of proper proportion and shape, it is a valuable aid to the exhaust and stack in creating draft, as well as a delivery tube to lead the exhaust into the stack. These capacities have been so long understood that we are apt to think the deflecting plate placed in front of the flue sheet in a smoke box, when the open stack and long exhaust pipe are used, has the same purposes, whereas it has but one and that is, to regulate the draft and distribute it evenly through the flues. Yet, while the plate cannot increase the draft created by the exhaust and stack, its position or length in front of the flues may interfere with the draft by obstructing the passage of the gases from the flues or in the way they are delivered into the smoke box.

With the long exhaust pipe and open stack, were there nothing intervening, the draft would naturally be from the upper flues, the point nearest the vacuum in the stack, or the point of draft induction created by the exhaust steam. To equalize this through all the flues the deflecting plate is used, and in its construction several things must be considered, the principal ones being its position or angle, and length. The plate should be long enough to cause the draft to be through all the lower flues, and its angle such that the area between its lower edges and the flue sheet shall be sufficient to permit the gases from the upper flues to pass under it freely. The position of the plate for performing this last duty is important, and when not considered affects the draft injuriously through the current from the lower flues filling the mouth of the opening, cutting off the draft from the upper flues. This defect is often remedied by bushing the nozzles and creating thereby a greater evil.

The angle of the plate, to obtain sufficient area between its end and the flue sheet, is, from the location of the upper end of the steam pipes compulsory, yet, were the steam pipes not a factor in the location of the plates, it would be necessary that it should have such an angle as would cause the gases from the flues to make an easy bend downward to pass under the plate and escape. The draft from the lower flues or those below the plate is directly outward and beyond the plate upward. That from behind the plate is outward, then downward to pass under the plate, while that coming from the flues immediately above the end of the plate and close to the power of the draft will quickly take the downward curve to pass under the deflector. The farther the flues are up behind the plate, the less the inducement is to cause the gases to deflect downward and they tend to strike direct against the plate. Were there no angle to the plate the gases would be dashed against it and confused, but with the proper angle to the plate the gases are deflected with an easy turn and sent in the proper direction.

This may seem a mere theory, but its truth can be confirmed by observing the back of a deflecting plate which has been set without having the proper angle. It will be found that an imprint has been made on the plate opposite each flue, faintly towards the bottom but growing more distinct with every ascending row. Where the angle was sufficient the plate will be found clean.

When the locations of the steam pipes are such that injurious obstruction will result from the use of a plain plate, another form can be used that will give good results, but it costs more to make than the first plate. This consists of a series of plates with an opening between each, that between the last plate and the bottom of the smoke box being the greatest. Each plate is set with its top edge on a line with the bottom edge of the preceding one, but far enough away to give an opening which permits the gases to pass upward in the direction of the stack. Each opening having but a few flues to serve the gases have an easy unobstructed passage to the stack. With a slight angle given to these plates the cinders will be deflected, and by their momentum carried downward when the outward draft from the bottom flues throw them to the front of the smoke box. The use of a plate being to regulate and distribute equally the draft through all the flues, the kind of plate that will produce this and direct the current of gases in the quickest and easiest way to the stack will give the best results. The principle of the resistance to the passage of a liquid that would have to make a sharp angle and meet with obstruction applies to the passage of gases through the flues and smoke box of a locomotive, and extra resistance must be overcome by extra work with the exhaust.

To Prevent Lamp Explosions.

An eminent British chemist recently delivered a lecture on "accidental explosions produced by non-explosive liquids," that contained many valuable hints to those using petroleum products for lighting purposes.

Dealing with the use of lamps, from which so many accidents still occur, in spite of the careful supervision over the sale of kerosene, he showed that, though a large proportion of such accidents were not due to actual explosion, yet explosions did occur, and he offered suggestions which would reduce, if not remove altogether, such accidents. The first was that the reservoir of the lamp should be of metal, and not of glass or earthenware; that there should be no opening or channel of communication with it near the burners, unless protected by wire gauze on the safety lamp principle, or unless its diameter did not exceed .04 inch. The wick should be soft, loosely plaited, so as to fill the holder without suffering compression, and never be much longer than sufficient to touch the bottom of the reservoir, and it should never be immersed to a less depth than one-third of that of the reservoir, which should be always almost filled before use. The flame should be lowered carefully, and, if it was to be kept burning in a lowered state, should not be beneath the metal work, but even then the vapor of unconsumed petroleum will escape, and cause an unpleasant smell. When it is to be extinguished, if it is not provided with an extinguisher which all good lamps now have, it should be lowered to a mere flicker, and, instead of blowing down the chimney, a sharp puff should be given across the top, the mouth being level therewith. A large collection of lamps was shown, from the earliest and crudest, some of which, as the lecturer showed by actual demonstration, were "warranted to produce an explosion on the shortest possible notice," thence ascending in the process of evolution to one to which he called special attention. This was a lamp by Messrs. Defries, embodying all the features which exhaustive scientific inquiry have proved to be necessary for the perfectly safe use of mineral oils. Its most striking feature is the small size of the wick reservoir, which is, however, kept well filled by a much larger separate surrounding reservoir, in which the oil is kept perfectly cool

A correspondent, referring to F. J. Masten's communication (March 14) on twist drill sockets, writes to say that in his experience the trouble with twist drill shanks and sockets is, that the fit is not made so that the drill enters the socket sufficiently deep enough to be driven properly by the flattened end. He says that in many he has examined, the driving must all be done from not more than $\frac{1}{8}$″ of the flattened part, which soon twists off, letting the socket turn on the drill.

A bishop visited a village in Louisiana recently, and the blacksmith of the place, who was a devout churchman wished to demonstrate his joy by firing a royal salute. The place did not possess a cannon, but it is a poor blacksmith who would be deprived of the pleasure of making noise with gunpowder because a regular cannon was not to be found. The Louisiana blacksmith was not so devoid of natural resources. There was a large gas-pipe valve in his shop, and he turned this into an improvised cannon. So that it should make plenty of noise, he filled the whole cavity with gunpowder and touched it off with a long red-hot rod. The rod proved hardly long enough, however, for, when the shot went off, the valve went to pieces, and part of it broke the pious blacksmith's leg.

Bad Luck Pursuing Engines and Engineers.

Railroad men are all acquainted with the curious run of bad luck that some locomotives have. On some roads there are engines that seem for a season always to be in trouble, no bad smash-up happening without their getting a share of the bruises. There are also singular features about the bad luck that pursues particular engines. One will have all its misfortunes on a certain division, while another will fall into trouble wherever it goes. Sometimes a train-man will have a run of bad luck that is entirely beyond the control of anything within his power, the careful man being pursued in this way as much as he who leads to disaster by recklessness. The train-man out of luck also meets with his misfortunes in certain divisions or in certain districts. These reflections came home to us on hearing that Engineer A. T. Calkins had been in a collision near Iowa City, and got his arm broken and was otherwise badly injured. This engineer we have known since he first started out, and he is as careful, sober and industrious a young man as there is in Iowa. One day, when he was just beginning to run extras, he started out with a snow plow to open the division that passes through Iowa City, and they had not gone far when a heavy bank was encountered, and snow plow and locomotive waltzed out into the prairie. Calkins got off pretty easy that time. Next turn he was not so fortunate. He started before daylight one morning with a train that ran over the same division. There had been a severe rain-storm during the night, which turned a small creek near Iowa City into a turbulent river, and the rushing water undermined the foundations of a railroad bridge. When Calkins reached this bridge, his engine went through into the flood and he was taken out terribly injured, but recovered after much suffering. He returned to work after a time on the same division, and now has met his third accident there. We trust that it is a case of the third accident changing the luck. In this last case the collision was caused by a mistake in order; so, like the other cases, it was entirely beyond control of the engineer.

Isaac H. Congdon, superintendent of motive power on Union Pacific Railroad, Omaha, who is well known as the inventor of the Congdon brake shoe, and other railroad appliances, has recently patented an improvement on car brakes. It is a combination of levers of scissors shape, which have the effect of equalizing on two pairs of trucks, the tension transmitted from the first lever or brake staff. He has also patented an improved means for casting axle boxes.

In the course of a recent discussion respecting the merits of cast iron cutlery it was asserted that the editor of *Van Nostrand's Engineering Magazine* had used a pair of cast iron scissors for three years, and that they were still in good order. We were disposed to question the durability of cast iron cutlery, but when scissors stood the wear those referred to were subjected to and still were capable of further use, we stand corrected.

Birkmann's Lathe and Drill Press Chuck.

This chuck, the invention of George Birkmann, 258 West 29th street, New York City, is represented in the accompanying detail engravings. It consists of a conical sleeve adapted to be screwed to the spindle, or to be otherwise attached to either the loose or fast spindle. This sleeve is connected by means of a screw collar with a cylindrical socket adapted to receive smaller sockets or bushings for holding pieces of different sizes.

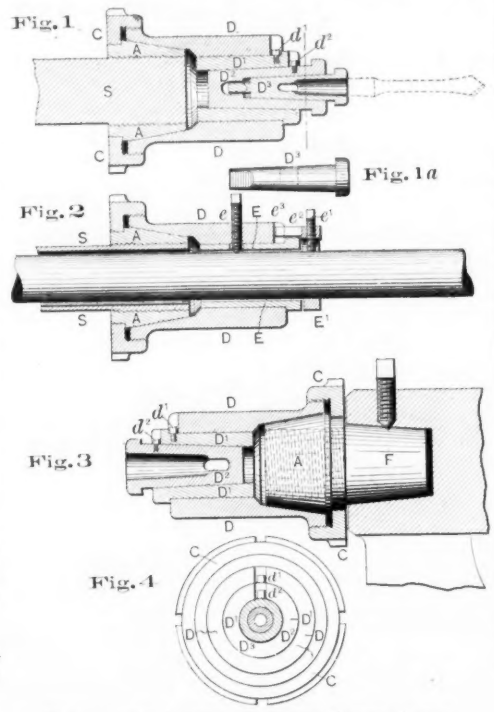
Fig. 1 is a section of chuck with detachable sockets in place, Fig. 1*a*, a side view of the smallest tool socket, Fig. 2 is a section of the chuck arranged to hold a shaft, Fig. 3 represents the chuck attached to the tail stock spindle of a lathe, and Fig. 4 is an end elevation and part section of chuck.

In these engravings *A* represents the conical sleeve that screws to the spindle *S*, shown in Figs. 1 and 2; *C* is the threaded collar that holds the main socket *D* in place. The main socket receives one or more smaller sockets, D_1, D^2, D^3, as clearly shown.

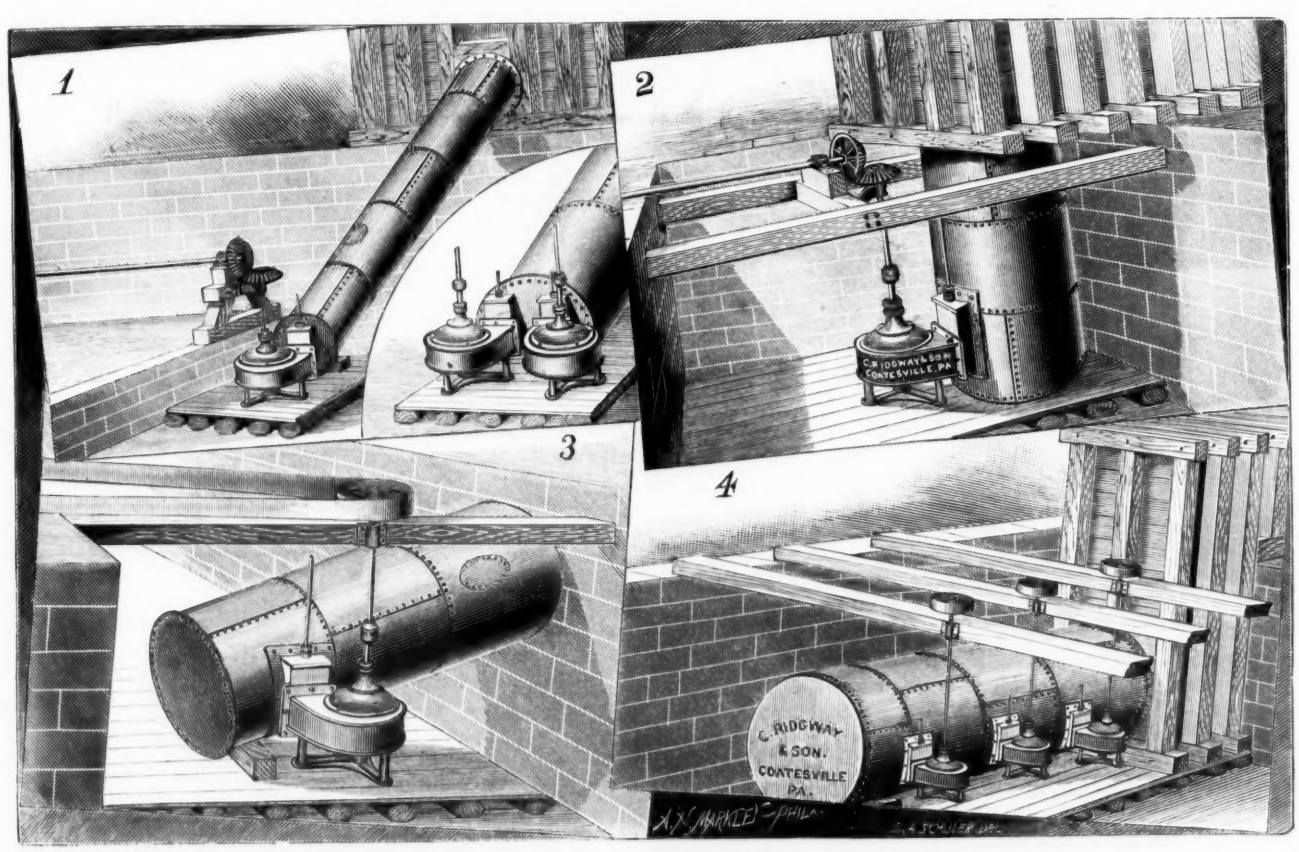
When the chuck is to be used for shafts cylinders sockets *E*, Fig. 2 are used, which are secured by set screws; collar E^1 prevents longitudinal motion.

Fig. 3, representing the chuck on the tool spindle, requires no explanation.

This chuck, we are informed by Mr. Birkmann, is in use by himself and others for various kinds of work for which it is suited with satisfactory results.



BIRKMANN'S LATHE AND DRILL PRESS CHUCK.



A GOOD USE FOR OLD BOILERS.

What is Done With Old Boilers.

Objections are frequently made to such a disposal of old boilers as works them around through the hands of the second-hand dealer, and out again to the user, by the judicious application of a few patches and a good deal of paint. They are not valuable for old stock owing to the expense of cutting up and getting ready for use. The manner of putting them to a useful purpose that is represented in the engraving, which is practiced by Craig Ridgway & Son, of Coatesville, Pa., is entirely unobjectionable. This company are the manufacturers of the well-known "Perfection" turbine water-wheel, which, being adapted to be set outside the water, makes the old boiler shells entirely suitable to conduct the water to them, without the necessity of building large cases in which to set the wheels. The construction of their wheels not calling for the expensive casing, they use iron piping very largely in place of the wooden pen-stock so much in use for small power, and they inform us that they find the old boiler shells, requiring but little work removing the heads patching holes, and cutting a hole to suit the wheel, to be an excellent and cheap substitute for the wooden tube.

The engraving shows four of the many ways these old shells are used.

No. 1 shows a shell leading the water directly from the forebay on an angle of 45 degrees. The small cut in the corner shows two wheels attached to another shell.

No. 2 shows a shell set vertically with a wheel bolted to the side of it, while the water is led into it by a wooden trough at the top, where there is no pressure.

No. 3 shows a shell on an angle with a wheel bolted to the side, when it is impossible, or not found desirable, to bolt it to the end.

No. 4 shows a shell laid horizontally in the pit, with three wheels fastened to its sides, and water brought to it by the wooden forebay at the right.

Old boiler shells placed in almost every conceivable position are utilized in setting these wheels, and serve the purpose quite a swell as new tubes.

Engineers' Stories.

A locomotive engineer, having written a letter to the *Monthly Journal*, giving some extraordinary experiences with cold weather, one incident being that the siphon of his steam gauge froze up while running on a dreadfully cold day, the members of the Brotherhood have taken up the subject and several of them give curious experiences in the April number of the *Journal*. Some of them have accepted the story of the frozen gauge, although it was no doubt true as a tall yarn, and tried to come one better.

Rory O'More tells how he was running the front engine of a double-header on a terrible December night, when the snow was drifted deep over the track, and a piercing frosty wind searched through every open crevice. In bucking through a heavy snow bank, the front end of Rory O'More's engine was broken in. With some fence boards he patched up the broken front, and started on. After running about a mile, he noticed his engine popping off in a manner which he never saw her do before, and no sound was proceeding from the stack. The engineer of the train engine kept whistling to Rory to go ahead, but he concluded something was wrong, and signaled to stop. He examined the eccentrics, links, rocker arms and steam chests, but could find nothing wrong, and after a prolonged search, discovered that the steam pipes were frozen, and would admit no steam to the cylinders.

Zero, who hails from the boreal regions around Marquette, in northern Michigan, relates how engineer Jones was out with a heavy freight train one cold night in January, with a slippery eight-wheel engine which stalled on a grade. The engineer becoming enraged at the engine, on account of her inability to take the train along, allowed her to stand and slip. Presently the slipping slowed down, and gradually ceased. The engineer was astonished at this, for the boiler had a full head of steam, so he went out to look for the cause. On arriving at the front of the engine he found her frozen to the track. The cold was so intense that the exhausts had frozen as they left the stack, and falling, one above the other, had formed a pyramid of ice from the top of the stack to the frozen ground!! Next?

In fitting up locomotive frames in the Pittsburgh Locomotive Works, unusually great care is taken to make all bolts a snug fit. The frames are drilled to templates, then the holes are reamed to take in an accurately fitting plug, which is $\frac{1}{1000}$″ smaller on one end than on the other. The hole must not take in the large end. Working with the minute measurements brought into apparency by the micrometer gauge is getting machinists to understand how fine they can do fitting. A few years ago, few machinists would undertake to fit anything closer than $\frac{1}{100}$ of an inch, but now, although their skill has not increased any, they readily undertake to fit to the $\frac{1}{1000}$ of an inch. This is because they know better what the fine measurement means.

A correspondent writes us that he has used both rawhide and compressed paper for small gear wheels, and prefers the latter.

Examination for Stationary Engineers.

Some time ago the owners of a large building erected in New York City put in an elaborate steam-heating and elevator machinery plant, and they required a good engineer to take charge. They were prepared to pay good salary to a suitable man, and this fact becoming known, a host of applicants became candidates for the place. As a means of helping to indicate what man would best suit the position, the candidates were required to take part in a competitive examination, the subjoined being the questions submitted. Few engineers would be able to answer half of the questions, but the publication of them will give engineers an idea of the range of knowledge required by those favoring the system of appointment through merit alone, and they may serve as a guide to study:

What is your name?

Your age, and where born?

Are you a machinist?

Where were you apprenticed, and number of years you worked at the trade?

Have you ever been a marine engineer?

Do you hold a United States certificate?

Of what grade?

Do you hold a local certificate?

Of what grade?

What is steam?

What are the properties of steam?

At what temperature does water boil at sea level?

What is the volume of steam from 1 cubic inch of water?

What is the temperature of steam, and volume at 1 pound above atmospheric pressure?

What is the temperature of steam at 60 pounds above atmospheric pressure?

What is the volume of steam at 60 pounds per square inch above atmospheric pressure?

What is latent heat?

What is sensible heat?

What is the British unit of heat?

What is the mechanical equivalent of heat?

What is the equivalent of a horse-power?

What is the horse-power of an engine—cylinder, 12″x18″; initial pressure, 80 pounds per square inch; cut-off, $\frac{1}{4}$ stroke; revolutions, 100 per minute?

If the initial pressure be 80 pounds per square inch, and cut-off $\frac{5}{8}$ stroke, what will be the terminal pressure?

What will be the point of cut-off to reduce the terminal to atmospheric pressure?

Have you ever used the indicator?

And whose make?

Draw an indicator diagram, and compute the horse-power from it, of an engine 14″x22″, initial pressure 75 pounds, cut-off $\frac{3}{4}$ stroke, revolutions 80 per minute?

Have you had any experience with piston valves?

State what other valves you are familiar with, and give a sketch of them.

What is lap and lead?

What is pre-release?

Of what benefit is compression?

What is the tensile strength of iron?

And of steel?

What is the safe working pressure per square inch of a tubular boiler 54″ diameter, plates $\frac{5}{16}$″ thick?

What pressure will be necessary to burst an iron boiler 30″ diameter, $\frac{5}{16}$″ thick, the diameter and pitch of rivets so they will shear off when the plates have reached the limits of their tensile strength?

Give a sketch of what you consider the best boiler stay?

And how a boiler should be stayed?

What grate surface do you allow in square feet per horse-power?

What is a fair allowance of heating surface per horse-power?

How much water will 1 pound of coal evaporate?

How much coal would be a fair average per horse-power per hour?

How much water evaporated per horse-power per hour?

Give a rule for computing the diameter of a safety valve for a given boiler?

Where is the best place to introduce the feed-water in a boiler?

Where should the blow-off pipe be situated?

When is the best time to remove clinkers from the fire-brick walls with the least injury to the brick?

Where should the connections be made in a boiler for the attachment of steam and water gauges?

Where should the steam and water gauges be situated?

What is your opinion as to the use of Croton water in boilers?

State your objections, if any?

What different make of steam gauges are you familiar with?

State maker's name, and draw a vertical section of them?

Have you had any experience in steam heating?

State where?

Would it be economy to use the exhaust steam for heating purposes, if it should throw a pressure of 2 pounds per square inch on piston?

What weight is required for a safety valve 4″ diameter, total length of lever 36″, from fulcrum to valve 4″, boiler pressure 80 pounds per square inch, weight of valve and connections 12 pounds?

What weight will be required on the end of a rope to counterbalance a weight of 40 pounds suspended from a movable sheave, the rope passing four times around the movable and stationary sheaves?

The diameter being 1, what is the area?

What is the square of 12?

What is the cubical capacity of a cylinder 4′x10′?

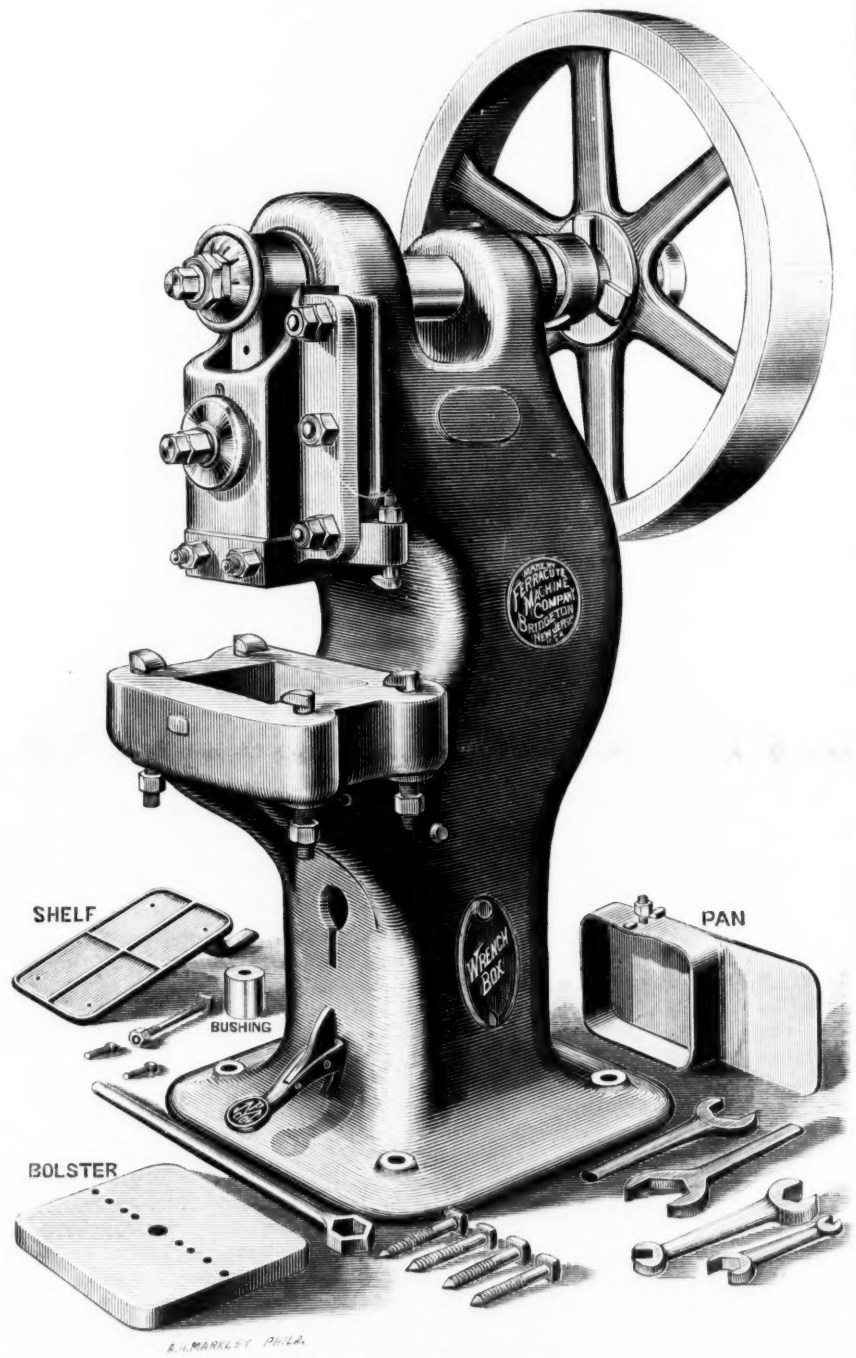
What is the pressure per square inch of a column of water 100′ high?

And at what height will it support a column of mercury?

Railroads in this country employ directly and indirectly 2,000,000 men.

A New Power Punching Press.

The press illustrated below represents the middle size of a new series of five back-wheeled power punching presses (called presses 51, 52, etc.) which have just been put on the market by the Ferracute Machine Company, of Bridgeton, N. J. These presses are especially adapted for cutting and punching articles in bar and thick sheet metals, such as nuts and washers, hardware, nails, locks, clockwork, cutlery, carriage goods, watches and jewelry, silver and brass work, gas fixture and lamp work, small parts of textile machinery, agricultural implements and musical instruments, and for trimming drop forgings, etc., etc. They are built with the frame, extending down in the form of a square hollow pedestal for a support, thus making them compact and simple. The shaft extends from front to back, and the fly-wheel is at the rear. They are heavily built and have forged steel shafts of large diameters.



New Power Punching Press.

Among the valuable improvements that are embodied in these presses may be mentioned the general design of the hollow column forming the frame, which is comparatively thin at the bottom, and swells out into large internal ribs to give the necessary strength between the bed and the shaft. The wide slide bar having long bearing, thus securing firmness and accuracy for the dies. A new eccentric adjustment by which the slide bar can be instantly clamped in place in any desired position and a graduated scale to faciliate the adjusting and enable the operator to more easily set dies. An improved automatic clutch, which enables the operator to perfectly control the action of the press. A "safety pin" to lock clutch, so the shaft can be revolved to any position, while fly-wheel is in motion, thus dispensing with the need of a countershaft. An adjustable spring brake which controls the motion of the press and adapts it to various speeds. A treadle-lock, by which the treadle can be held down for continuous running when required. Also die and stripper clamps, by which dies and strippers can be held securely in place without the use of bolts.

A number of extra attachments, or appliances are also made for these presses, which adapt them to a great variety of work and increase their usefulness. They consist of a positive stop, by which the slide bar is prevented from making more than one stroke when the treadle is depressed, until the locking arrangement has been released, even though the treadle be held down for an indefinite period. An adjustable stroke by which slide bar can have a short stroke for heavy work, and a longer one for special work, requiring less power. A shelf which may be bolted to either side of the press for holding work or tools. A pan to catch punchings and "drop through" work, which may also be reversed and used as an inclined chute to catch work and slide it over to the left of the press.

The weights in this series of presses run from 700 lbs. in the smallest (press 51), to 5,700 lbs. in the largest (press 55). The smallest press will cut an inch round hole in $\frac{1}{8}$″ iron, while the largest will cut the same size hole in 1″ iron. They are also so arranged that gearing can be added to any of the five sizes, at a small extra cost, which adapts them to a great variety of work, requiring slow motion and great power.

The dimensions of the press 53, illustrated, are as follows: weight 2,400 lbs.; height from floor to top of fly-wheel, 74 inches; hole through bed, 8 inches by 10 inches; width between die clamps in the clear, 15 inches; distance back from center of slide bar frame, 8 inches; height from bed to slide bar when at highest point, $7\frac{1}{2}$ inches; stroke of slide bar $1\frac{1}{2}$ inches; adjustment of slide bar 1 inch; diameter of fly-wheel 36 inches; width of fly-wheel 6 inches; weight of fly-wheel 460 lbs.; speed of fly-wheel 100 revolutions per minute.

The Amende Honorable.

Some of the English scientists who attended the Montreal meeting of the British Association, and subsequently visited throughout the United States, gave their countrymen most discouraging descriptions of American engineering works. The other side of the picture has now been shown by Mr. Arthur Rigg, C. E., a well-known writer on the steam engine, in a paper recently read before a scientific society. The paper is an interesting descriptive account of what an intelligent traveler may see during a rapid journey through part of the Northern and Western States. In the introduction he says: "Some have gone so far as to say there is nothing to be learned or observed in that wide and boundless dominion, which to our unceasing satisfaction is in possession of the Anglo-Saxon race, and not under the control of any foreign nation. To suppose that men of the most energetic race on earth could possibly develop the resources of a new country, abounding with every potentiality of wealth, without doing anything a traveler from their ancestral home may not see and study with advantage, is to confess a want of observation on the part of the visitor—an utter blindness, indeed, that carries contradiction convincing and complete to any statement so absurd. Indeed, so far is a contrary view the fact, that one might petrify the whole country as it now stands, and then spend the length of a long lifetime without exhausting its boundless subjects of interest, or, indeed, dipping very far below the surface of what we see."

Mr. E. B. Ellington, M. I. C. E., in a paper read before the Liverpool Engineering Society, on the subject of supplying hydraulic power in large cities, gives the cost to the user as a maximum of three cents and a minimum of $\frac{1}{2}$ cent per 50 foot tons of work actually done.

LETTERS FROM PRACTICAL MEN.

Melting Steel in an Ordinary Cupola.

Editor American Machinist:

In the American Machinist of July 5, 1884, I inquired, at the close of an article, for information on melting steel scrap in an ordinary cupola. While this inquiry attracted considerable attention and brought us a number of letters, we failed to get any direct information on the subject. The nearest that any letter came to indicating that this had been accomplished was one now in my possession, from a firm in Philadelphia, commission agents in the iron and steel trade, to the plow department of these works. I quote from their very generous offer:

"Some time ago your foreman asked some questions which interested a friend of ours, who answered and sent sample, but who is not giving anything away through the newspapers, as you requested. Send us orders for all your wants in our line."

We are very thankful to the firm referred for their very unselfish (?) offer; but experimenting has brought results beyond anything we anticipated, and we are *glad* to "give it away through the newspapers," trusting it will benefit some one. We know of no journal wherein the information can be better circulated among men who will appreciate it than through the columns of the journal that contains this article.

The American Machinist of August 23 contained an account of "Melting Steel in an Ordinary Cupola." Since then, by experimenting, we have learned something of the nature of it, and not only found the class of work we can use it in to best advantage, but have also made a decided improvement in manner of melting and fluidity of metal. The method of charging is different from the account I gave in the article referred to. We have not melted a heat of steel alone, not having occasion to melt more than 1,000 to 2,000 pounds at a time. We continue to melt it right behind the cast iron portion of the heat.

As soon as the last charge of cast iron begins to settle away from the charging door, in melting 2,000 pounds of steel in two charges in the 30" cupola, we put on 200 pounds of coke and 1,200 pounds of steel, then 100 pounds of coke and 800 pounds of steel, melting at the rate of 6⅔ to 1. We keep the cupola full of steel up to the charging doors until the last has been put on; this gives it the benefit of a longer heat, and when it reaches the melting point it comes down—to use the expression of a moulder here—"hot enough to run a needle with the point up." It is very fluid when it first comes from the cupola. While it does not remain fluid as long as cast iron, I am satisfied a very large piece could be poured with it. I notice by agitating it in the ladle it "gums up" around the ladle quicker than cast iron.

Charging in this manner, the cast iron all melts down ahead of the steel. Then there is a cessation in the melting for a few minutes before the steel starts; once started, it melts very fast. The appearance of the metal is so different from cast iron in the fluid state, that we can tell it as soon as it starts from the cupola.

This steel scrap is of a class known as "slab or agricultural steel," and we have melted 60,000 out of the 75,000 pounds I stated we had on hand, besides using up all the scrap that has been made since then. We are going to try a part of the heat of steel rails as soon as we work up what scrap we have on hand. By itself the steel runs porous. By adding ⅛ cast iron to the charges we find it runs the castings very close and solid, and harder than the steel alone. For furnace liners, back plates, grate bars, brake shoes, etc., it is superior and more serviceable than cast iron. In light castings annealed I feel sure it would make stronger castings that malleable iron.

Last Fall J. C. Albrecht, M. M., of the railroad shops here complained about the chilled truck wheels, shipped him here for section masters' hand-cars, cutting out and getting flat places in them in a short time. We asked him to let us make a set of steel rim wheels for a trial. He placed an order with us for two sets of wheels, steel rim, 26" dia., 3½" face, ¾" thick, 1" flange, ten ¾" round wrought iron spokes, set zig zag in hub, hub of cast iron, weight of wheel 120 lbs. They have had to stand the test through the most severe winter we have had in the South for years. Having filled orders for 150 since then is evidence of the satisfaction they are giving.

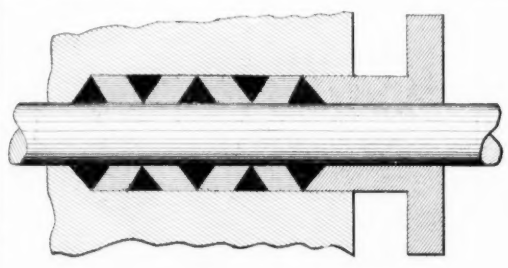
In January we received an order from Savannah for one wheel, as a test wheel for the Central R. R. Since then we have filled orders for several set. The Atlanta *Constitution* said of them a short time ago: "Car wheels made at the Columbus Iron Works are found to be superior to those made at the North. This scores one more point in this age of progress."

I send you by this mail sample of casting made entirely from steel scrap. We broke the sample in two; one half has been drawn out at the forge to a sharp edge and tried in the planer to see how it would cut. It is most too hard to work with any speed, and must be worked at a very low heat at the forge. The other half is just as it came from the sand.

I have written to a number of men who were moulders before I was born, also to a number of younger men who are experienced in the foundry business, to learn if they could give me any points on this subject. The answer in substance from all has been: "I fail to find any one who has had any experience in melting steel in an ordinary cupola." If any reader of the American Machinist can tell us when and where this has been practiced before, we would be glad to hear from him through the columns of your journal.

Robert E. Masters.

[The specimens our correspondent refers to show that very satisfactory results have been obtained.]



Piston-Rod Packing.

Editor American Machinist:

If "R. I.," who wants information about packing his piston-rod, will pack it as in the sketch, I think his trouble will cease. The black triangular pieces are pure rubber, cut in lengths to fit rod and packed between with hemp. A little plumbago should be used on the rubber to prevent sticking.

T. J. Loftus.

Short Stroke Marine Engines.

Editor American Machinist:

In your issue of March 28 there is a short editorial condemning the proportions of certain compound engines, designed for marine service, in this country and in England.

Without entering the realms of theory to prove or disprove that a short stroke in a compound engine is a fault, I would remark that this type of engine has been largely developed in the marine service, and the practical results obtained have not as yet been excelled.

During the many years that these engines have been in successful operation, the efforts of marine engineers have been, not merely to make an engine that would develop a certain power with a certain pressure of steam, but to design an engine that would develop the greatest power with the least amount of steam, occupy the least space, weigh the least in proportion to its power, and make long continuous runs with the minimum of care and attention—in short, to economize in every particular.

That great progress has been made in all these directions the records of the marine service will readily prove. The same records will also prove that diameters are gradually growing in proportion to strokes.

It cannot be denied that in the naval service, at times, one point has to be sacrificed for the attainment of a more essential object. Still, no designer would permit of a sacrifice that would radically impair the efficiency of the engine; and from the economic results obtained from some notably short-stroke engines in the English navy, it would appear that nothing has been sacrificed in that particular.

In the merchant marine and yacht service the designer is not hampered by such considerations; and in order to attain the best results, we find the engines of some noted steamers proportioned as follows:

The steamship City of Richmond:

High-pressure cylinder	76"x60"
Low " "	120"x60"
Revolutions per minute	55
Indicated horse-power	3,430
I.H.P. per square foot of grate surface	5.86
" " " heating "	0.188

The steamship Thorwaldsen:

High-pressure cylinder	51"x42"
Low " "	86"x42"
Revolutions per minute	60
Indicated horse-power	1,580
Coal per I.H.P. per hour	1.75 lbs.

The steamship Parisian:

High-pressure cylinder	60"x60"
Two low-pressure cylinders, each	85"x60"
Revolutions per minute	85
Indicated horse-power	6,020
I.H.P. of main engine per square foot of grate surface	11.06
I.H.P. of main engine per square foot of heating surface	0.396

The condensing water was circulated by centrifugal pumps driven by independent engines. The steam required to operate these engines was drawn from main boilers.

The steamship Gallia:

High-pressure cylinder	63"x60"
Two low-pressure cylinders, each	80"x60"

Mean results obtained during a voyage across the Atlantic:

Average indicated horse-power	5,261
Coal per I.H.P. of main engines per hour	1.73 lbs.
I.H.P. of main engines per square foot of grate surface	9.8
I.H.P. of main engines per square foot of heating surface	0.46

The condensing water was circulated by two Gwynne centrifugal pumps, driven by independent engines, 11x11. Only one pump and engine was usually in use, but the steam required to drive it is included in the table above, and if credit were given for it, would make a still better showing for the main engine.

The steamship Italia:

High-pressure cylinder	46"x42"
Low " "	86"x42"
Revolutions per minute	60
Average pressure of steam	70 lbs.

Two independent steam pumps were used for feeding boilers. Steam cylinders, 8"x9"; water cylinders, 4"x9".

Steamed 838 hours, at an average speed of 10.65 knots per hour, with a consumption of 845 tons of coal.

The steamships Ohio, Pennsylvania, Indiana, and Illinois:

High-pressure cylinder	57¼"x48"
Low " "	90⅛"x48"

Results obtained on the Ohio:

Steam pressure	60 lbs.
Revolutions per minute	60
Indicated horse-power	1,978
I.H.P. per square foot of grate surface	7.27
" " " heating "	0.413

I would also refer to the following naval steamers, the engines of which have proven by results that no mistake has been made in proportioning diameter to stroke.

Torpedo boat in British navy, built by Thornycroft:

High-pressure cylinder	12¾"x12"
Low " "	20⅞"x12"

Condensing water is circulated by a centrifugal pump, driven by an independent engine.

Air is forced into fire-hold by a fan, driven direct by an independent engine, 5"x3".

The steam to drive both of these, in the table below, is charged to the main engine.

Revolutions of fan per minute	986
Pressure in fire-hold	6"
Temperature of waste gases	1444°
" feed water	56°
Steam pressure	115 lbs.
Coal burned per hour	1,815 "
Coal per square foot of grate surface per hour	96.03 "
Coal per square foot of heating surface per hour	2 93 "
Water used per hour	10,841 "
Water used per hour per square foot of grate surface	573 "
Water used per hour per square foot of heating surface	17.54 "
Water evaporated per pound of coal	5.97 "
Revolutions per minute	443
Indicated horse-power of main engines	469
Water per I.H.P. per hour	23.11 lbs.
Coal " " "	3 87 "
I.H.P. per square foot of grate surface	26.05
" " " heating "	0.742

H.M.S. Tenedos:

High-pressure cylinder	57"x30"
Low " "	90"x30"
Revolutions per minute	60.31, 75.2, 99.7
Steam pressure	60 lbs.
Number of expansions	9, 9.5, 6.5
Coal burned per hour,	700 lbs., 1,167 lbs., 4,681 lbs.
Indicated horse-power	443, 867, 2018
Coal per I.H.P. per hour,	1.58 lb., 1.35 lb., 2.32 lbs.
I.H.P. per square foot of heating surface,	0.077, 0.15, 0.35
I.H.P. per square foot of grate surface,	2.46, 4.82, 11.2

During the last trial the steam blast had to be used to keep up steam.

H.M.S. corvette Rover:

High-pressure cylinder	72"x48"
Two low-pressure cylinders each	88"x48"
Revolutions per minute	68.5
Steam pressure	70 lbs.
Indicated horse-power	4,964
I.H.P. per square foot of grate surface	9.73
" " " heating "	0 89

Gunboat in British Navy:

High-pressure cylinder	28"x18"
Low " "	48"x18"
Revolutions per minute	130
Indicated horse-power	473
Coal per I.H.P. of main engine per hour,	3 lbs.
I.H.P. of main engine per square foot of grate surface	10.14
I.H.P. of main engine per square foot of heating surface	0.368

Steam blast through two nozzles, one-fourth to full open all the time. Circulating pump and fans were driven by a small vertical engine. Pump lifted about 90 tons of water per hour.

Coal required for this engine is charged against main engine in above table.

H.M.S. Boadicea:

High-pressure cylinder	73"x48"
Two low-pressure cylinders, each	92"x48"

Condensing water was circulated by centrifugal pumps driven by independent engines. The coal required to furnish steam for the engine has been charged to main engine in the table below.

Revolutions per minute	75
Indicated horse-power	5,640
Coal per I.H.P. of main engines per hour,	1.8 lb.
I.H.P. of main engines per square foot of grate surface	9
I.H.P. of main engines per square foot of heating surface	0.4

H.M.S. Coquette:

High-pressure cylinder	31"x18"
Low " "	48"x18"
Revolutions per minute	123
Indicated horse-power	405
I.H.P. per square foot of grate surface	9.1
" " " heating "	0.325

H.M.S. Satellite:

High-pressure cylinder	36"x30"
Low " "	62"x30"

Condensing water is circulated by a cen-

trifugal pump, driven by an independent engine.

Two fans forced air into the fire-hold. Each fan was driven direct by a three-cylinder Brotherhood engine, 7x4; speed, 400 revolutions per minute.

Air pressure in fire-hold	1″
Steam pressure	80 lbs.
Indicated horse-power	1,397
I.H.P. of main engines per square foot of grate surface	16.9
I.H.P. of main engines per square foot of heating surface	0.641
H.M.S. Conqueror:	
High-pressure cylinder	54″x36″
Two low-pressure cylinders, each	70″x36″

Condensing water was circulated by a centrifugal pump, driven by an independent engine.

Six fans forced air into the fire-hold. Each fan was driven direct by a three-cylinder Brotherhood engine, 7″x4½″.

Air pressure in fire-hold	1¾″
Steam pressure	63 lbs.
Indicated horse-power	4,023
I.H.P. of main engines per square foot of grate surface	13.41
I.H.P. of main engines per square foot of heating surface	0.584
H.M.S. Nelson:	
High-pressure cylinder	60″x42″
Low " "	104″x42″
Revolutions per minute	82
Steam pressure	65 lbs.
Indicated horse-power	6,624
I.H.P. per square foot of grate surface.	10.9
" " " heating "	0.379
Imperial Russian frigate General Admiral	
High-pressure cylinder	92″x48″
Low " "	130″x48″
Steam pressure	60 lbs.
Revolutions per minute	65
Indicated horse-power	6,300

In the article referred to no reason was assigned for classifying the proportions mentioned as an aggravated fault, and it is the writer's belief that it originated more from hasty judgment, or perhaps prejudice, than from careful consideration.

If the author has any valid objections, will he please present them, so that we may clearly understand on what grounds his opinion is based.

While in the marine service no very long stroke compound engines exist, still there are some whose proportions differ considerably from those mentioned, but the writer knows of none that give better results.

A. G. Brown.

Destructive Hydraulic Pressure Tests.

Editor American Machinist:

Will you allow me to rise and explain my position regarding the hydraulic test of steam boilers.

The article by Mr. J. E. Jerrold, in the April 11th number of American Machinist, conveys the impression that I am opposed to this method of testing boilers, while controversies carried on in the earlier numbers of your paper, in which I have taken part, show that, for several years at least, I have been a strong advocate of this test, when properly applied. Think it is a good thing, but, like many other good things, believe we can get too much of it. Too much hydraulic test commences the instant when the pressure exceeds the limit of elasticity of the metal of which the boiler is made.

Just what pressure the test-gauge will show when that limit is reached, is a question that would take too much of your valuable space to fully discuss at this time, but it is evident that a test piece cut from a plate is but a poor approximation of what strain the metal will stand when worked up into a boiler shell. Carefully conducted tests prove this fact beyond question.

It is generally conceded by engineers well up in the business, that a working pressure of 5,000 lbs. per square inch of section is all that the metal of a boiler should be subjected to, and, so far as the writer knows, there is no "steam boiler inspection ordinance" that requires a hydraulic pressure test of over thirty-three and one-third per cent. in excess of the working pressure to be put on a boiler, and the only safety seems to be in fixing a limit that is low enough to prevent excessive strain.

While Mr. Jerrold has kindly assured us of the responsibility "both practically and financially of the party who ordered this test," he failed to answer the most interesting portion of our inquiry, viz.: what object is to be gained by it?

Will Mr. Jerrold also tell us how his several high-pressure tests have proved that no injury has been done by them? It is true he does not say that no injury has been done, but the idea conveyed is to that effect.

The writer believes that a full understanding of this question of safe pressure by steam users as well as by boiler makers would greatly lessen the chances of destructive boiler explosions, and it is with the object of helping to spread this information, that he is always ready to discuss this question.

W. H. Odell.

Cylinder Oils—Economical Size for Engines.

Editor American Machinist:

In your issue of April 11th, I notice Benj. F. Hetherington has got "even" with an oil man, and is using lard oil in his cylinder. Is he sure he is working to his own advantage?

All animal oils contain a certain amount of acid, and in the process of refining more is added. This acid is set free by steam heat, and attacks the metal; and he will notice that the inside of his piston is turned into the oxide of iron, which can be scraped off. There will also be trouble with the follower bolts, and they will be short-lived. Winter refined sperm oil will not oxidize the metal, but there will be a large amount of gum deposited, making things rather sticky. This also obtains, though in a less degree, with lard oil.

There are petroleum cylinder oils manufactured, that will lubricate as well as the lard oil, don't cost as much, will not injure the metal, and will keep every part free from gum.

"Superintendent" inquires about the size of engines, when first cost and economy of fuel are both taken into account.

He can determine this for himself by constructing diagrams cutting off at ½, ⅓, ¼, etc., then let him assume any size cylinder, and find the amount of water per horse-power at release, and it will tell him all he has inquired. Then take the amount of coal per horse-power, and compare it with the cost of the assumed engines.

He will find ¼ to be about the right thing for economy of fuel, but when the cost of plant is taken into account, ⅓ may be nearer the correct thing.

W. E. Crane.

Waterbury, Conn.

Piston Rod and Valve Steam Packing.

Editor American Machinist:

Wishing to add my mite to the question of how to pack a piston rod stuffing box, after having read your various correspondents' methods, all of which are entitled to consideration, the one nearest to my own experience is that of Mr. Crane's cone-shaped rubber arrangement. My experience as an engineer is, that whatever material is required for any purpose it must—1st. be easily procured, and 2d. quickly prepared for use.

Some years ago I used to pack the piston rod of a certain engine in the following manner: I procured a piece of vulcanized gum without any cloth in it, about three-eighths of an inch thick, its width half-inch less than the depth of the stuffing-box, and of sufficient length to fit neatly into it. Before putting it in I would cut it in two lenthgwise and break joints when introducing it; finally, a hemp gasket was prepared and drove in with a packing stick until the box was full, tapering the end of packing so as to make a neat finish, bringing up the follower and screwing it in until it touched the gum. This was all the screwing the follower ever got, and the packing would last from 90 to 100 days run, boiler pressure 90 lbs., piston speed 300 ft. per minute. With care the gum would last for three or four packings. The idea was given me by a friend who got it from watching the engineers of a certain railroad packing their piston rods. I used this packing for years, and only gave it up when some of the earliest prepared fibrous packing was being introduced. The new innovation enabled me to do without such help to pack my stuffing-boxes.

Five or six years ago I was somewhat prejudiced against "Tuck" packing, but I have got over it, but not without losing some of my pet theories. At that time I was running an engine whose piston rod was moving all over the engine room, so to speak. For a long time the piston rod had been packed with "Tuck" packing, and I thought this was a good time and place to try a favorite fibrous packing. I did not forget to descant largely upon its good qualities. Well, I got my packing in, but rued it most fearfully before I was forty-eight hours older. I was never sold on a stuffing-box packing so bad in my life. In went "Tuck" again and stayed there too. It is still my favorite for a rod or valve stem that is hard to keep packed. I have a couple of cases now—valve stems of a vertical engine. I prepare my packing three or four weeks before I want it. I have procured pieces of wrought iron pipe, whose diameters are slightly larger than the stuffing boxes into which I place sections enough of the packing to fill the boxes. They are then put in the cylinder oil-can and left there two or three days, when they are taken out, and hung up in a convenient place to drain off until they are wanted. By this time they have taken the shape of the packing boxes, and are comparatively soft and pliable. As a rule the stuffing-boxes leak no water since I have adopted this plan.

Wm. J. Williams.

Philadelphia, Pa.

Marking Patterns with Chalk.

Editor American Machinist:

Having had some experience with moulders, I take great interest in reading your valuable paper and correspondence in the foundry line with regard to the trouble your correspondent has in obtaining the number of castings marked on the patterns with chalk. I am of the opinion that it is not the fault of the chalk, but looseness in the management of the foundry. It is impossible for a foreman to keep each small pattern in his memory where a large miscellaneous business is carried on, but the chalk is good enough for me, and all that is necessary. The foreman should first see that each pattern is plainly marked when he gives the same to the moulder; then see that each moulder is provided with a piece of chalk, and then require him, as soon as he is through with the pattern, to mark the number on the patterns which remains to be made. The imperfect castings, of which there will be some in the best of shops, should be carried out each day, and always put in the same place. The foreman should either report any loss himself or expect each man to look out for his own imperfections. Thus, should a man be absent, the foreman can look at the patterns on any man's floor or bench and know how each piece stands. To carry this method out successfully, the men must be made to understand that to properly attend to this matter is of as much importance as any other duty they have to perform, and, though it may possibly be necessary to change some of the slack ones to get this method thoroughly established, as soon as the men really know that this is one important part of their duty it will, in a great measure, remedy the difficulty.

Foreman Moulder.

Milling Taper Work.

Editor American Machinist:

The following was accidentally omitted by me from my article on the above subject in your issue of April 18. It relates to Fig. 7 in that issue, and describes what I consider one of the most important advantages shown in that device. It is that the tail-block, when being adjusted to the length of the work, moves in a line parallel with its center; so that the angular adjustment of the center is always the same for a given taper, regardless of the length of the work, which is not the case with Figs. 4 and 6. This renders the graduations on the elevating head available, and the arc *c* may be provided with any special graduations, such as various tapers to the foot.

Fred. J. Miller.

Electricity in a Saw Table.

Editor American Machinist:

I notice in this week's issue (April 18) an article headed "Curious Electrical Disturbances". Allow me to state that the same phenomenon happened to me a couple of years ago, while working in an electric light dynamo manufactory. I was cutting some round brass rods on a circular saw, the same being about 6″ in diameter, when I accidentally noticed that when the rod came in contact with the iron table or saw, it emitted a bright blue spark, the same as when the fingers are held near an electrically charged belt; but there was not that cracking noise. This only happened when the saw was in motion. The sparks were drawn anywhere on the table. The rest of the table, or bottom part that rested on the floor, was made of wood. I came to the conclusion that it was probably caused by the belt imparting the electricity contained in it to the arbor. Not being well posted on electricity, and not being an electrician, I could not solve the mystery any further.

R. Boisset.

Mr. Henry Waterman, who is so well known for his inventions connected with the fire engine and other lines of machinery, died at his residence, Hudson, N. Y., on April 7.

Where Charity Begins Abroad.

The McCormick reaper factory, in Chicago, which earned an enormous fortune for its originator, has received considerable public notice lately owing to the owners having decided to bestow a gift of $100,000 to endow a theological seminary. The religious world had scarcely begun to applaud the nobility of this gift, when the donors received public attention in a less gratifying manner. The Trades Assembly, of Chicago, has appointed a committee to wait upon the owners of the McCormick factory and request that the workmen employed in the establishment who have gone out on strike may be given living wages. It is said that the wages of many employes in these works have had their pay reduced repeatedly, with the evident purpose of seeing how long they would endure new reductions, till now the remuneration given is below the means of supporting life. The men who have gone out on strike say it is as well to starve idle as to starve toiling like slaves to obtain half a living. The philanthropists who believe the men are foolish to refuse half a loaf in hard times, scarcely realize the terribly hard work involved in earning the half loaf. The McCormick reaper factory has got the contract system of production well worked out, and the men are their own taskmasters with low rates to lash them onward. There is of course distress among the men and they anathematize the system that turns them into veritable slaves. This kind of gift will bring them far more free advertising than beginning charity at home and permitting the men who earn the profits to share in their benefits.

The North-Eastern Railway, of England, are laying down three-quarters of a mile of iron railroad ties to test their durability and adaptibility to the work. The iron ties are nine feet long, the same as the wooden ones, are nine inches wide, and weigh about 225 pounds each. They are fitted with a cushioned steel chair for holding the rail, and it is riveted to the tie. If this form of tie proves satisfactory in service, the company will use it in place of timber ties.

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Chimney Efficiency and Boiler Tests.

Manufacturers of boilers often have just cause to complain of the manner in which their boilers are used, in that they do not get credit for results that would obtain under reasonably favorable conditions. The old time method of rating a boiler by its ability to furnish steam, by the horse-power, to an engine that may use it economically, or quite the reverse, has happily gone by. It never did have any significance since the time—even if it did then—when it was considered that an engine required, or ought to require, a cubic foot of water per horse-power per hour. It always left the boiler maker most unsatisfactory ground upon which to stand. But even according to modern rating, that established at the Centennial tests, the boiler maker is not always sure of his footing. Unfortunately his contract does not generally call for furnishing the chimney. He may agree to furnish a boiler of specified horse-power, according to modern rating, and build one that under fair conditions would be of ample capacity, but when it is put up the draught may be so deficient that it will fall far short. A boiler may be large or small according as the chimney draught is good or bad, and so far as his boiler is concerned the height and area of chimney may not determine the draught. It has been in the experience of most engineers to note that when two or more boilers are connected with the same single flue chimney, the draught of one or more of them will be defective, and that it is sometimes a troublesome matter to determine the cause. Now with one or more boilers already in use the boiler maker may agree to furnish another that shall have a given capacity, and when put in place and connected to the same flue it may utterly fail to work up to contract. A test in such a case will seldom satisfy either the purchaser or seller. The chimney may be too small, or it may be ample, and still the failure may not be from any fault in the boiler. Perhaps the seller may, by the expenditure of time and money, demonstrate that he can do what he contracted to, but it is more probable, especially if not an ordinary type of boiler, that if his work is accepted it will continue to stand as an unfortunate advertisement for him. Sometimes a boiler may get the credit of doing as much as two or three others, simply because it gets better draught—perhaps the whole draught of the chimney, none too large for one boiler—but what is credit for one is unjust condemnation of the others.

It is a step in the right direction to have an established rating for steam boilers, but, in justice to the manufacturer, the conditions as to draught under which they shall evaporate the fixed amount of water should be explicitly stated. We have in mind an instance in which a boiler was furnished under contract that it should supply steam for a certain engine. It was put up by the purchaser, connected to a chimney which had already a larger boiler connected with it, and would not more than about half supply the engine. The purchaser notified the builder that he should not accept it, and it took a good deal of managing to bring about putting the old boiler out of use long enough to demonstrate that the new one, if given fair usage, was ample for the purpose.

Boiler makers have a right when furnishing a boiler of a specified capacity for steam making, to object to tests with other boilers in operation connected to the same flue, unless their contract contemplated running under these conditions. Tests under such circumstances have often been made to work injury to the builders of good boilers. But exactly what the boiler maker has a right to insist upon in the way of chimney draught and capacity when his work is submitted to a test for determining if he has fulfilled the requirements of his contract as to evaporative efficiency seems to be undetermined. It ought to be as explicit as the statements of the number of pounds of water to be evaporated for a commercial horse-power. This is essential, at least to the builder.

Supply the Articles Customers Want.

Numerous cases have occurred where trade with foreign countries has been lost through manufacturers or dealers insisting that people they want to supply with commodities should use the same patterns popular in the country where they were made. The loss by the English of the ax trade, through dealers persisting in sending the flat English ax abroad, where the wedge-shaped American ax was wanted, is a familiar instance. The Mexican trade journals are now calling attention to the fact that American dealers, who are striving to supply Mexico with commodities, are falling into the same mistake. There are certain tools and implements greatly used in Mexico that have fallen into peculiar shapes adapted to the habits of the people, and American dealers are trying to substitute other forms made after their own patterns. This innovation Mexicans are inclined to oppose in the effectual fashion of refusing to buy the articles. It would be the course of wisdom for our merchants to ascertain exactly what is needed by their would-be Mexican customers, and try to supply the demand with first-class articles. Now is the right time to gain a permanent hold of that trade, and, if it is lost through mismanagement, many years of intelligently-conducted canvassing will be needed to regain lost ground.

A committee of the Master Car Builders' Association, consisting of G. W. Rhodes, of the C., B. and Q. Railroad; Geo. Hackney, of the A., T. and S. Fe Railroad, and B. Welch, of the Central Pacific Railroad, issue a circular calling for information about automatic car-brakes from those who have had any experience with brakes of this description. If the association is ever going to make its influence felt by standing up for particular patterns of car equipments, they must begin doing so at the approaching convention, and their action is looked forward to with keen interest. There are now only two or three continuous freight-car brakes in the race for adoption, and the sooner an authoritative decision is reached the better it will be for all parties concerned.

In another column will be found an interesting letter from Mr. Robert E. Masters, describing his operations in melting steel in an ordinary cupola. The work was done at the Columbus Iron Works, Columbus, Ga., and was so successful that the firm have received several orders for castings made under the process perfected by Mr. Masters, and there appears to be a probability that considerable new business will be derived from this source. All the success attending the operations is due to Mr. Masters, who has worked the process out without aid from others. When he proposed experimenting with melting steel in an ordinary cupola, he tried to obtain information from foundrymen who had done something in that line, but those that were in a position to impart any information answered that they were not giving anything away through newspapers. Mr. Masters is more liberal and gives freely for the benefit of the trade the particulars of his valuable operations. He finds that steel mixed with cast iron makes a much closer casting than steel alone. We believe with him that castings made in this way would, after annealing, be stronger than malleable iron castings, and might be usefully applied for many purposes.

An iron company in Sheffield, England, has been feeling the pressure of hard times so heavy, lately, that the firm began to get embarrassed, and could not compete evenly with their rivals. The workmen got to understand the true state of affairs, and they resolved to help out their employers. Owing to the regulations of the trades unions they could not work for lower pay than what was common in the trades, but they volunteered to work a week for nothing, and the offer was gratefully accepted.

A Co-operative Success.

The method of conducting strikes, like many other things, has undergone notable improvement, during the last few years. We do not mean by the introduction of boycotting, for that plan is liable to have a reflex action which in the end proves disastrous to those beginning it. The old fashioned plan of striking is for a body of workmen to quit work together and remain idle until driven by necessity to resume work, or until they gain what they ask for, or find it useless to demand it any longer.

The new method is for the workmen in certain trades to quit work and proceed at once to start co-operative factories to employ themselves. The new plan is much more likely to succeed than the old one. It has recently succeeded with the hatters of South Norwalk who by making an extra good quality of hats in their two co-operative factories have secured considerable of the trade formerly enjoyed by their employers. The latter have now conceded the points in dispute, and harmony once more reigns. But the co-operative works will still go on.

Boiler Accidents in Minnesota.

The State of Minnesota does not possess many manufactures with power derived from steam boilers; yet, on looking over the record of boiler explosions, we find the State furnishing a fair percentage of these calamities. The legislature of that State, in a session just closed, has made an effort to prevent accidents to steam boilers by passing a law requiring all engineers of all classes of steam boilers to be examined, to show their ability and experience before taking charge. Owners of boilers are subjected to a heavy penalty for employing men in charge of boilers that do not hold the inspectors' certificate of competency, and men who take charge of boilers without passing the examination are liable to be severely punished. Most accidents to boilers in the Northwestern States are with agricultural portable engine boilers, and the knowledge required from men who take charge of such boilers is very limited. The principal requirement is, generally, ability to look after moving the engine round. If the law would compel owners of steam boilers to use a good automatic safety valve, we believe it would save many lives.

Energy Utilized in Different Engines.

A good steam engine utilizes only about 12 per cent. of the potential energy of the carbon and hydro-carbon contained in each pound of coal consumed in the furnace. The efficiency of certain electric motors deriving their power from batteries is considerably higher than the steam engine, but zinc and copper are so expensive fuel that the work from an efficient electric battery costs much more than the work done by a wasteful steam engine. Certain kinds of gas engines show a very high efficiency, but there are practical difficulties that prevent their application extensively for ordinary pioneer purposes. There is an impression among many engineers that explosives give forth a high per centage of the total energy contained in their composition when properly applied, but the cases where the force exerted by gunpowder on projectiles has been carefully calculated do not indicate that a cannon is much more economical than a steam engine. Recent German experiments in this line indicated that seventeen per cent. of the total energy of gunpowder was converted into useful work. The greatest amount of mechanical energy exerted on the earth is derived from vegetation. Compared with the way the product of the soil is converted into work, the steam engine does not fall very much behind. It takes the average product of two acres of land to keep a horse for a year and during that time it will do work equivalent to what will be performed by a steam engine on three tons coal consumption, giving about the same proportion of useful effort.

In another page Mr. A. G. Brown, an esteemed correspondent, takes us to task for the expressions of a short editorial note, wherein we questioned the correctness of design of certain compound marine engines with excessively short piston stroke. We believe that within certain limits a short piston stroke is conducive to economy, but in the cases we referred to, where the stroke was considerably less than the diameter of the high-pressure cylinder, it appeared to us that the limit had been passed. The figures which our correspondent gives, showing the cylinder details of well-known marine engines, and the fuel consumed in doing work, although interesting as engineering data, do not appear to support the position our correspondent has taken. The most economical record cited under fair load is 1.73 lbs. coal per indicated h. p. per hour, which was done with a high-pressure cylinder, 63x60 inches. This is equal to the longest stroke given. The steamship Hudson, with single cylinder only 48″ diameter, but with a stroke of 6 feet, has a record of one horse-power on 1.75 lb. coal. It appears reasonable that in this case the proportionately longer stroke made up for the increased efficiency of compound engines; or, to state it another way, if the compound engines had the advantage of longer stroke, they would have beaten the Hudson's record.

Secretary Whitney appears determined that the government shall not accept any of the new vessels for the Navy unless they are built strictly up to the contract. Although a good deal of pressure was put upon him to accept the dispatch boat *Dolphin* without any more trial or investigation he has declined to do so, and appointed a board of examination to investigate whether or not the vessel is what the specifications called for. The Secretary while nominating gentlemen who are not members of the Advisory board, to make the investigation, gives notice that he does not mean to reflect on the members of the Advisory board by this action, but we cannot help thinking that the naval men belonging to the board who designed the vessel were the proper parties to tell how near it came to their requirements.

Brotherhood of Locomotive Engineers.

On the 5th of April there was a largely-attended union meeting of locomotive engineers at Scranton, Pa., to establish a division of the Brotherhood of Locomotive Engineers at that place. There was formerly a division at Scranton, but it broke up during the troubles connected with the Reading strike of 1877, and the charter was returned. The new division is called the "Sam Sloan," after the president of the Delaware, Lackawanna & Western Railroad, who has expressed himself warmly in favor of the brotherhood. It starts out under unusually favorable conditions with a large membership.

During the times of conflict between railroad companies and the Brotherhood of Locomotive Engineers in 1877, many of the weaklings in the order thought Gowan would succeed in his threat of annihilating the order, and they resigned rather than face the conflict. The organization proved stronger than Mr. Gowan *et al* reckoned on, and the order came out of the fight stronger than ever, and most of the weak members long since sought and obtained the shelter of the fold, which is in all cases freely given where the men have not been guilty of dishonorable actions. As it has continued to grow in strength and numbers, the Brotherhood of Locomotive Engineers appears to have increased in conservatism. When any cloud appears that might lead to trouble, great care is taken to avoid a storm. They persistently refuse to give up their last resort of striking to obtain justice, but the constitution is so framed that a few hot heads cannot of their own accord precipitate a strike, and this means of obtaining redress is rarely necessary. Just a few days ago, Grand Chief Arthur was called to consult about the trouble between engineers and the management of a southern railroad, where the men had given notice that they would strike; but when Mr. Arthur got there he decided the men had no real grievance, and they were told to continue at work, which they decided to do.

Some of the best friends of this brotherhood think it should go on record against striking under any circumstances, as the Brotherhood of Railway Conductors have done, but their advice is overruled. Those taking the other side say it is not good to have the sting taken away entirely, even if it is merely kept as an ornament. Since the hard times, the men who manage the Gould roads have found it necessary to make material reductions on the pay of conductors, but engineers have not suffered by the leveling downward process. Of course, the difference in treatment merely arises from the fact that engineers hold a warm place in the hearts of railroad magnates, but the men themselves think their employers treat them justly because they do not want to fight their strong brotherhood, which still retains the strike sting. There is an impression among many people that nearly all railroad officers dislike the Locomotive Engineers' Brotherhood. This is a great mistake. Many of the best railroad managers commend the organization, because they think it raises the standard of their engineers; and the lower order of officers favor it because it is a power that stands between unscrupulous magnates and their schemes of general cutting down of wages. While the locomotive engineer is paid about $100 a month, the dispatcher and train masters and superintendents will not be cut below that figure. Many of them think they would have considerably lower salaries but for the barrier against general reduction presented indirectly by the brotherhood.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(131) W. M., Webster, Mass., will find information on worm gearing in the American Machinist of February 7, 1880, and September 1, 1883.

(132) J. S., Lambertville, N. J., asks: Of what is phosphor-bronze composed? *A.*—Ordinary bronze mixtures, to which from two to four per cent. phosphorus is added.

(133) A. A., Minneapolis, Minn., asks: Should a key in a locomotive driving axle fit the hardest on the top and bottom, or on the sides? *A.*—Our opinion is that it should fit hardest at the sides.

(134) R., Providence, R. I., asks: Can a condenser be used to advantage on an engine making 290 to 300 revolutions? *A.*—There are several forms of independent condensers that can be satisfactorily used on any engine without reference to speed.

(135) G. A., New Orleans, La., writes: I am building a vertical engine, 2″x3″. What should be size of ports and lap of valve? *A.*—For 400 to 500 revolutions per minute you can make steam ports 3-16″x1″, exhaust port 3/8″x1″, outside lap 3-16″, inside lap 1-32″, travel of valve 3/4″.

(136) R. C., Nashville, Tenn., asks: In an engine 6″x10″, with steam ports 5/8″x4″, exhaust port 1¼″x4″, and bridges 5/8″, what should be the length of valve, what the width of exhaust cavity, and what the travel? *A.*—Length of valve, 4¾″; width of cavity, 2 5-16″; travel of valve, 2⅜″, will do very well for fairly high speed.

(137) W. H. D. T., Pittsburgh, Pa., asks: What is actual cost of one horse-power per hour, size of cylinder, revolutions per minute, including fuel, wages of engineer, etc.? *A.*—It will vary more than 100 per cent. No definite answer can be given. You can get the information you ask for as to loads, speeds, and duration of wire rope, from the manufacturers.

(138) W. T. S., Hunter's Mills, Va., asks: Is it proper to use the word stack when speaking of a chimney of a locomotive or portable engine, or should it be used only when speaking of several chimneys together? *A.*—Common usage makes it proper to apply the word stack to a single chimney. One of Webster's definitions of the word is: "A single passage way for smoke; the chimney of a locomotive or steam vessel."

(139) Novice, Warren, O., says: Will an engine weighing, say, 4,000 pounds, with four wheels coupled, haul more than same engine with only two wheels connected with the cylinders? And if so, how much? *A.*—That will depend entirely on the amount of power transmitted from the cylinders. If these do not give out power enough to slip a single pair of drivers, there is no use coupling the second pair of wheels, and no benefit would result from so doing.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Katzenstein metallic packing, 169 Christopher st., NY

Curtis Pressure Regulator and St'm Trap. Apr. 18, p 12

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Tools for amateur and foot-power lathes. Send for illustrations. Hartford Tool Co., Hartford, Ct.

The Young Engineer's Own Book, $3. Edw. Meeks, Publisher, 1002 Walnut St., Phila., Pa.

Second-hand stean engine indicator wanted. Describe instrument and state lowest cash price. Address Box 277, Poughkeepsie, N.Y.

Kellam's Steam Pressure Regulator is meeting with great favor. See cut, page 12.

Lukens' wage card, needed in every shop. Price, $1.00. Lukens & Shreve, Camden, N. J.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N.J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Cooper, On the Use of Belting, $3.50. Edw. Meeks, Publisher, 1002 Walnut St., Phila., Pa.

Engineers, send for sample Eureka Packing. Will please you. Hine & Robertson, 12 Cortlandt St., N.Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

A few chucks, of all kinds, for sale at half price. Slightly damaged. Send for list to the maker, A. F. Cushman, Hartford, Conn.

The outline ("wax process") engravings shown in the Am. Machinist each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught," $4. Books for workmen Joshua Rose, Box 3306, New York City.

Locomotive Engine Running and Management. By Angus Sinclair. Price $2. An excellent book for men interested in steam engineering, valve setting, designing valve motion, the care of the Westinghouse brake, etc. Published by John Wiley & Sons, 15 Astor Place, N. Y.

Useful Information for Steam Users—A 100-page pamphlet, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Every engineer should have this book. Send 25c. in P. O. stamps to the J. N. Mills Publishing Company, 145 Broadway, N. Y.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

Manufactures.

James Noble, Jr., Anniston, Ala., will soon build boiler works.

Washington Grim, Orlando, Fla., is building a carriage factory.

Burchell & Thompson, Wytheville, Va., will establish a tinware factory.

The Central Railroad Company, of Savannah, Ga., are erecting another addition to their shops.

The Dow Wire Works Company, paid-in capital $60,000, has been incorporated in Louisville, Ky.

The Hayden Brass Works, at Lorain, O., have orders for 30,000 valves, which means three months' work.

The citizens of Lansing, Mich., have authorized the Common Council to borrow $100,000 for water works.

George Wald, 798 Atlantic Avenue, Brooklyn, N. Y., will build a 25x85-foot carriage factory, to cost $3,000.

The roller skate factory at Mechanic Falls, Me., runs fifteen hours a day, and the proprietor is behind on orders.

J. & C. Fisher, 417 West Twenty-seventh Street, New York City, will erect an addition to their piano factory, seven stories high.

The tack factory of White, Cheney & Neff, of Taunton, Mass., recently destroyed by fire, will be rebuilt on the old site this spring by John H. Eddy, who owned the burned building. The new factory will be larger than the old one.

D. R. Sperry & Co., manufacturers of hollow ware, caldrons, etc., North Aurora, Ill., are now rebuilding their shops, which were destroyed by fire.

G. Vollmer & Co., 1,108 Chestnut Street, Philadelphia, will erect a six-story brick furniture factory at 1,110 to 1,116 Sansom Street. Estimated cost, $85,000.

The Louisville & Nashville Railroad Company, will immediately build two machine shops at Tenth and Zane Streets, Louisville, Ky. Estimated cost, $60,000.

Thos. T. Marshall, of Pittsburgh, Pa., formerly of Morris & Marshall, who have dissolved partnership, will erect a new foundry and machine shop. Estimated cost, $50,000.

The H. B. Smith Manufacturing Company, Westfield, Mass., contemplate building a foundry and machine shop, engine and boiler rooms, and storage quarters this spring.

The Union Metallic Cartridge Company, Bridgeport, Conn., have received an order for 50,000,000 cartridges from the English government, and one for 100,000,000 cartridges from the Russian government.

The Plymouth Cordage Company, of Plymouth, Mass., who recently lost two mills by fire, have concluded to rebuild. They will erect a building 400 feet long by 180 feet wide, one story high in front, with basement in rear.

The Hydro-Carbonated Coal Gas Company, of Columbus City, Ind., lately incorporated, have purchased a machine shop and foundry for their works. They will manufacture gas apparatus for residences, stores, and breweries.

General T. Torrance and Dwight Cameron, First National Bank Building, Chicago, Ill., have just purchased an old rolling mill property, and are going to turn it into a nail and car wheel works. They paid for property $75,000. Capital, $250,000.

Forbes & Curtis, Bridgeport, Conn., report trade better in their specialties just now than for a long time ast. They are also manufacturing an adjustable screw plate for H. D. Barnes, which is to be put upon the market by the Barnes Tool Company of New Haven, Conn.

A new co-operative concern is to start soon in New Brighton. A company of workingmen, numbering 75 men, have purchased a building there, and are placing in it the machinery necessary for operating a wire mill. The capital stock of the corporation is $50,000.

Dwight F. Cameron and Joseph H. Torrence have just purchased the rolling mill at Evansville, Ind., and intend to move it to Cummings, Cook County, Ill. The Evansville plant, for which $75,000 has now been paid, originally cost $350,000, the machinery being of the best, and to start up the removed and improved works at Cummings will cost some $250,000 to $300,000.

William Lowe, proprietor of the Bridgeport (Conn.) Boiler Works, has issued a "General History of Stationary Steam Boilers, and Description of the Lowe Boiler." In addition to specific information of the Lowe boiler, the book contains valuable information relating to all the more common forms of boilers, their comparative cost, economy, efficiency, space occupied, etc.

The Pittsburgh *Chronicle-Telegraph* says: "J. & J. B. Milholland, machinists and engine builders, have just completed a small mine engine that will serve as a model of neatness and economy. It was built for Hartley & Marshall, proprietors of the Enterprise Coal Works. The dimensions, general design, and materials employed in constructing 'The Little Black Diamond,' will be interesting to all engaged in mining and to mechanics generally. The boiler (steel) is thirty inches in diameter, eight and a-half feet long, and contains fifty-eight 1¾-inch tubes. The water tank (saddle-placed over the boiler) gives the engine a compact appearance. It would be impossible to get more in the same space. The boiler is supplied with two locomotive inspirator injectors, one on each side. The cylinders are six inches in diameter, with twelve-inch stroke. The steam is distributed by the ordinary link motion, and it is intended to carry from 150 to 200 pounds' pressure. The frame, like the boiler and tank, is constructed with a view to strength and durability. It is made of steel, is continuous, twelve inches wide and an inch thick. The engine is supplied with six driving wheels twenty-four inches in diameter, with seven feet wheel base. It is designed to run upon a very narrow gauge track (two feet), and the manner in which the tank and frame have been constructed to meet the requirements is a peculiar feature of the work. The engine, which weighs six tons, is the second Hartley & Marshall have ordered. The first was made in England two years ago. The engine just completed will be employed in the mine, and it is calculated will haul 1,000 tons of coal in ten hours a distance of one mile, that being the length of the 'run.' The 'Little Black Diamond' is the second narrow gauge engine J. & J. B. Milholland have constructed. The firm are now prepared to build engines of this pattern in connection with their other specialties. The engine has been tested in the works for several days to the entire satisfaction of the purchasers, and will be shipped next week."

Jacob Doll will erect a five-story factory, to cost $40,000, on 30th Street near 1st Avenue, New York.

The Fitchburg Railroad Company, it is reported, contemplate building a repair shop at Greenfield, Mass.

There is a rumor that Maine Central Railroad car shops, employing two hundred men, are to be erected in Brewer, Me.

The factories at Great Falls, N. H., are running on short time on account of low water. They better put in steam engines.

A committee from the Troy Scientific Association is considering the practicability of establishing an industrial school in Troy, N. Y.

The envelope machines used by the Mann Envelope Company, Ballston, N. Y., were made by the Gage Machine Works, of Waterford—not at the envelope works, as we stated in a former issue.

Machinists' Supplies and Iron.

NEW YORK, April 9, 1885

There has been no noteworthy change in the supply trade since our last report was made. The oft reiterated complaint of low prices is still resounded, and the backward weather of the season exercises a depressing influence on the spring trade.

The trade in boiler plate and tank iron is quiet. A fair volume of business has been transacted during the week, and the leading mills are fairly employed; but in this line is also heard complaints of low prices. Dealers here are not different from dealers in other lines in their hatred of small margins of profit.

Iron.—A fair volume of business has been done in pig during the week, but prices showed no signs of improvement. In fact, concessions from the quoted prices were occasionally made to secure sales. The shading down was done mostly on the lower grades of iron. We quote Standard Lehigh brands at tidewater $18 to $18.50, for No. 1 X Foundry, $17 to $17.50 for No. 2 X, and $14.50 to $15.50 for Grey Forge at furnace.

Scotch Pig.—There is no change for the better in this trade, and business is confined to purchases to arrive. We quote Shotts, $21.50 to arrive; Coltness, $21.50 to arrive; Glengarnock, $19 to $19.50 to arrive; Gartsherrie, $20.50; Carnbroe, $19 to arrive; Eglinton, $18 to $18.50; Langloan, $21; and Dalmellington, $19.

Copper.—The market for ingot is slightly firmer, but the demand is light. Lake is quoted at 10¾ to 11 cents; other brands, 10¼ to 10⅝ cents.

Lead.—The market for common pig has been dull and weak. There have been sales made at 3.60 cents, but holders ask 3.65 to 3.70 cents.

Tin.—The market for ingot has ruled quiet and firm. The demand has been moderate, but the sales have been light. We quote for jobbing lots, Banca, 18¼ to 18¾ cents; Straits and Malacca, 17¾ cents each.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Position wanted—supt or chief draftsman. Address J. C. S., AM. MACHINIST.

Situation by first-class patternmaker accustomed to make working drawings. T. C., AM. MACHINIST.

Wanted—Position as traveling salesman for some firm manufacturing specialties. Address Salesman, AM. MACHINIST.

Position wanted by young man as cost clerk, bookkeeper, or draftsman, city or country. A. B., AM. MACHINIST.

Wanted—Situation as foreman or superintendent of machine shop; good recommendations. Address Lock Box 568, Philadelphia, Pa.

Wanted in a small jobbing shop having good tools, a working foreman machinist, competent to get out work good and cheaply; good wages and steady employment to a competent man; no other need apply. Address Box 293, Dallas, Texas.

Wanted—Situation, by young man, as mechanical draftsman with patent solicitor, machine shop, mechanical engineer, or draftsman; graduate of Sci. College; engineering and machine shop experience; references given. Address S.S. Salter, Boston, Mass.

Wanted, on a salary, as salesman and sole general representative upon the road of a well known manufactory, a gentleman of good address, tact and business ability. Must be thoroughly acquainted with machinery, and well grounded in mechanical principles. Unexceptionable references will be required. Address "Carpenter," P O. Box 773, N.Y.

Wanted—Present address of T. R. Bell. Send to L. Bartlett, M. M., Missouri Pacific Railway, St. Louis, Mo.

Wanted—Partner with $3,000 to $5,000 in machine shop; business been established five years, and well advertised. P. O. Box 54, Chattanooga, Tenn.

Wanted—Second-hand back-geared screw-cutting lathe, 3½ to 4-foot bed; must be in first-class order and cheap. Address "Cash," office AM. MACHINIST.

Business opportunity is offered by advertiser, who proposes manufacturing a class of skilled labor-saving machinery extensively used in Europe, and now *being imported*, with excellent results, to this country; the demand rapidly increasing. Minimum capital, $50,000. For particulars address "A," care AM MACHINIST.

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Barnes' Wood and Iron-Working
MACHINERY,
Lathes,
SCROLL and CIRCULAR SAWS,
UPRIGHT DRILLS, MORTISERS, &c.
Machines sent on Trial.
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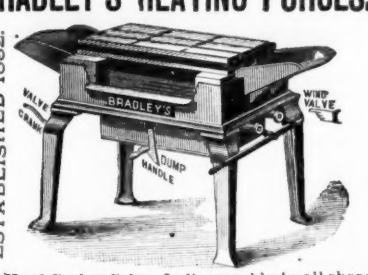
BRADLEY'S HEATING FORGES.



For Hard Coal or Coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.
BRADLEY & CO. Syracuse. N.Y

SPECIAL NOTICE.
All parties making, selling or using an Upright or Helve Power Hammer having a Cushioned Vibrating Saddle, infringe our patents, and we shall hold them legally liable for the same.
BRADLEY & COMPANY, Syracuse, N. Y.

H.W.JOHNS'
ASBESTOS
PACKING,
Our improved elastic Asbestos Piston Rod Packing is made from the best quality of pure Asbestos fiber and is the most perfect, compact, and durable Packing ever produced for locomotive, marine, and other engines.
Asbestos Wick Packing,
Asbestos Mill Board and Sheathing,
Asbestos Gaskets and Rings,
Asbestos and Rubber Tape and Cloth.
Asbestos Boiler Coverings.
Our Asbestos Cement Felting is the most effective and durable Non-conducting covering for Steam Pipes, Boilers, Stills, and other Steam-Heated Surfaces.
Asbestos Hot Blast Cement Felting,
Asbestos Air Chamber Covering,
Asbestos Locomotive Lagging,
Asbestos and Hair Woven Felt,
ASBESTOS ROOFING.
Asbestos Building Felt.
Asbestos Cloths, Cord, Twine, Yarn, and Sewing Twine, Asbestos Gasket and Retort Cements, etc.
LIQUID PAINTS, and PURE COLORS.
DESCRIPTIVE PRICE LIST AND SAMPLES FREE.
H. W. JOHNS M'F'G CO.
Sole Manufacturers.
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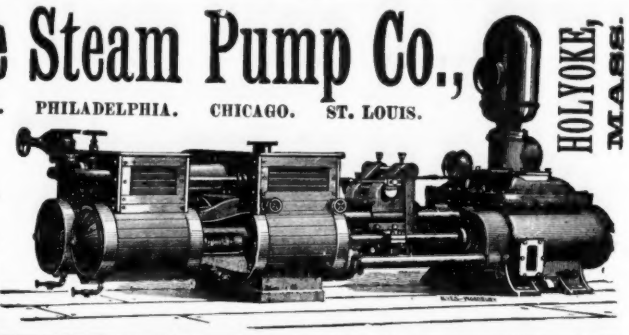
175 Randolph St., Chicago. 170 N. 4th St., Philadelphia.
Billiter House, London.

STEPHENS PATENT VISES.

50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by the trade. Send for circular.
MELVIN STEPHENS, Prop'r,
Office, 41 Dey St., New York.

Massey's "E AND K" PATENT VISES

The Deane Steam Pump Co.,
HOLYOKE, MASS.
NEW YORK. BOSTON. PHILADELPHIA. CHICAGO. ST. LOUIS.
MANUFACTURE
PUMPING MACHINERY
FOR ALL DUTIES.
Send for New Illustrated Catalogue.



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From 1-4 TO 15,000 lbs. WEIGHT.
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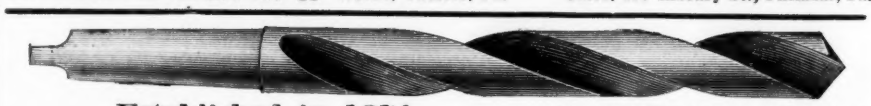
Stronger and more durable than iron forgings in any position or for any service whatever.
20,000 CRANK SHAFTS and 15,000 GEAR WHEELS of this steel now running prove this.
Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives.
STEEL CASTINGS of every description.
Send for Circulars and Prices to
CHESTER STEEL CASTINGS CO.,
Works, Chester, Pa. Office, 407 Library St., Philada., Pa.



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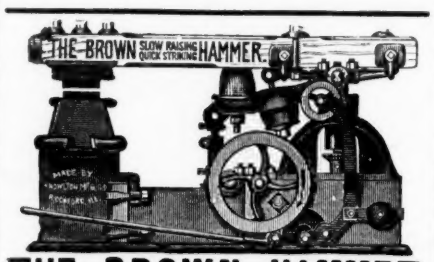
24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

Sebastian, May & Co.'s
Improved Screw Cutting
FOOT or POWER LATHE.
14"x40", 6' bed, price $175.
Catalogue of Lathes Drill Presses and Machinists Tools and Supplies. Mailed on application. Lathes on Trial.
136 & 138 W. Pearl St., Cincinnati, O.

BINDERS FOR THE AMERICAN MACHINIST, $1.00 BY MAIL. 96 FULTON STREET, N. Y.



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STRIKES A BLOW WITH
DOUBLE THE VELOCITY That it Raises the Hammer.
A NEW MOVEMENT (SEND FOR DESCRIPTION,
KNOWLTON MFG. CO., King St., Rockford, Ill.

BOILER FEEDER,
(A Pump and Heater Combined.)
Guaranteed to make more steam with less fuel than any other way of feeding boilers. Send for circulars. Agents wanted.
D. E. RICE,
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The Fireman's Guide.
A Handbook on the
CARE OF BOILERS
By KARL P. DAHLSTROM, M. E.
Crown 8vo, Cloth, 50 Cents.
E. & F. N. SPON, 35 Murray St., New York.

Locomotive Engine Running and Management.
By ANGUS SINCLAIR, M. E.
A practical book by a practical locomotive engineer. It treats of the proper way to handle engines, running different kinds of trains, from the limited express to way freight, with plain directions how to act in any case of trouble with the engine. Valve gear and link motion made plain by numerous engravings. Easy directions regarding setting valves. The working of the Westinghouse air brake carefully explained and clearly illustrated. Many other particulars about the locomotive that every engineer ought to know. Gives particulars of examinations that firemen must pass on leading roads before being promoted.
With many Illustrations. 12mo, Cloth. $2.00.
John Wiley & Sons, 15 Astor Place, New York.

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Machinery and Supplies,
22 CORTLANDT ST., NEW YORK.
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The Waters Perfect Governor.
Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also
SUPPLIES
For Machinists, Railways, Mills, Mines, &c.
Please send for circular and state that you saw the advertisement in this paper.

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A SPECIALTY.
Correspondence Solicited. Pond Engineering Co., St. Louis, Mo.

The Fox pat. Universal Trimmer
A valuable Tool on Pattern Work.

CUTS SQUARE, or ANY ANGLE. Send for Circular.
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Manufacturers of STRAIGHT LIP INCREASE TWIST DRILLS and Special Tools.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS.
JAS. HUNTER & SON, North Adams, Mass.

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New and Complete Illustrated Catalogue
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BLAKE'S IMPROVED STEAM
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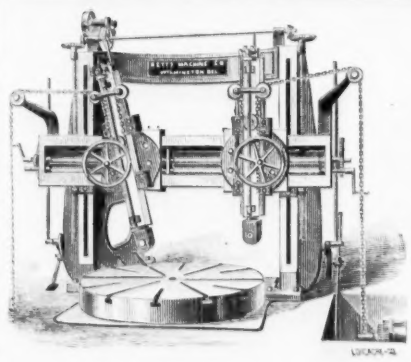
SEND FOR A COPY.
ADDRESS,
GEO. F. BLAKE MANUFACTURING COMPANY
95 & 97 LIBERTY STREET, NEW YORK. | 44 WASHINGTON STREET, BOSTON.



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MAKERS OF
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BORING AND TURNING MILLS
OF MODERN DESIGN AND
FIRST-CLASS WORKMANSHIP.
Sizes up to 14 Feet Swing.

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SOLE MANUFACTURERS OF

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HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS AND SPECIALTIES.

"Nicholson File Co's" Files and Rasps, "Double Ender" Saw Files, "Slim" Saw Files, "Racer" Horse Rasps, Handled Rifflers, Machinists' Scrapers, File Brushes, File Cards, Surface File Holders, Vise File Holders, Stub Files and Holders, Improved Butchers' Steels.

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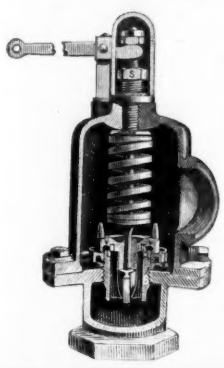

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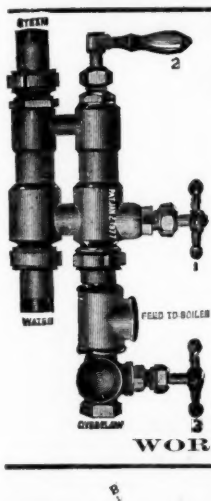

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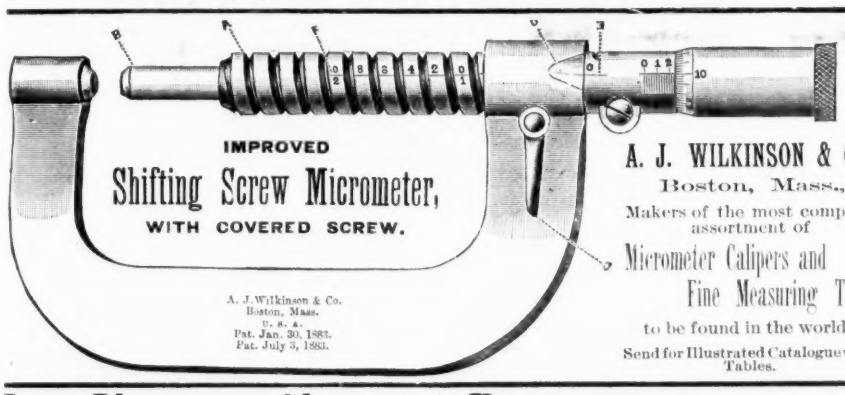

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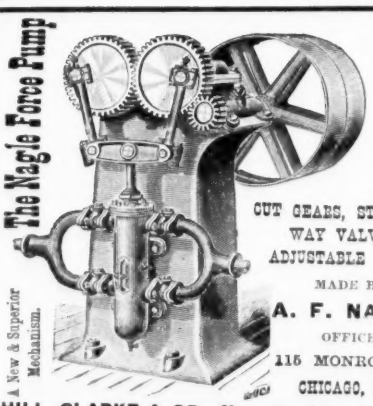

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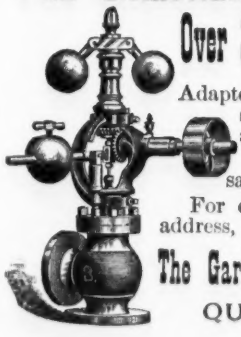

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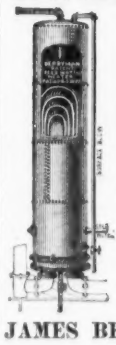

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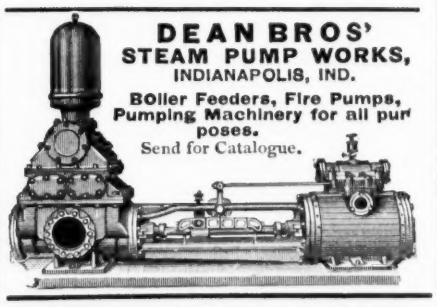

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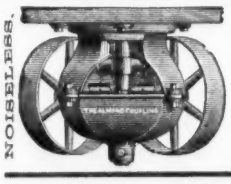

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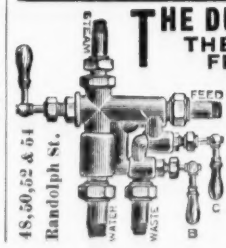

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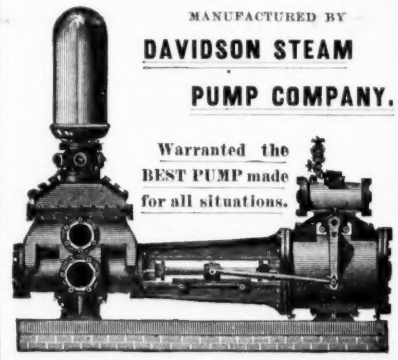

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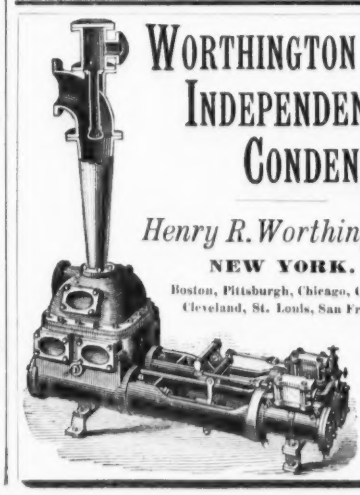

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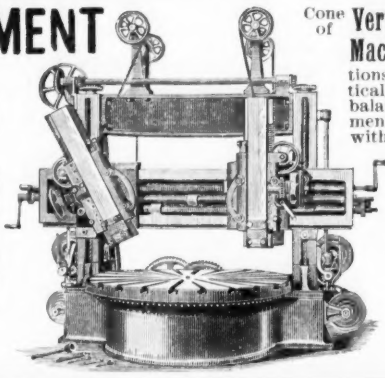

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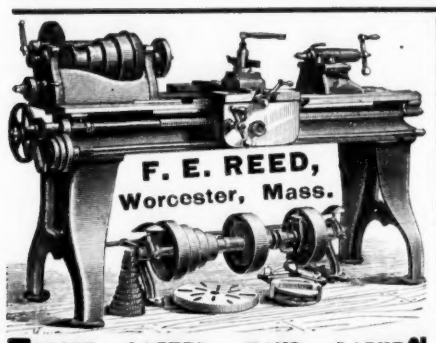

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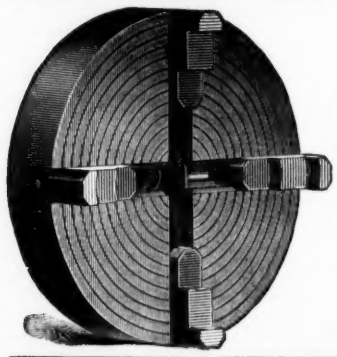

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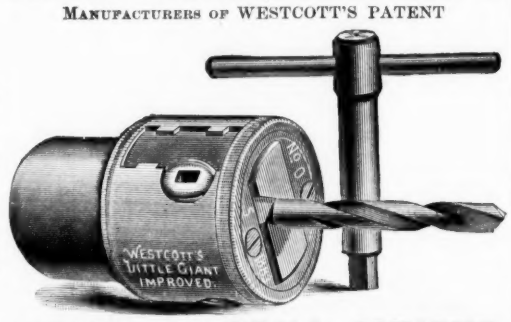

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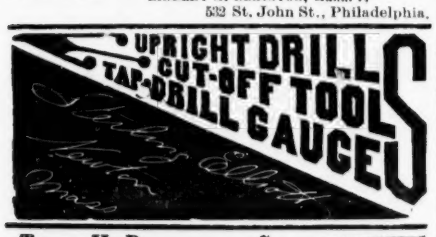

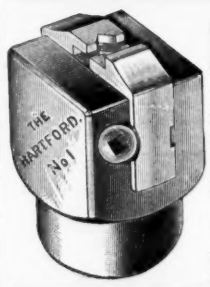

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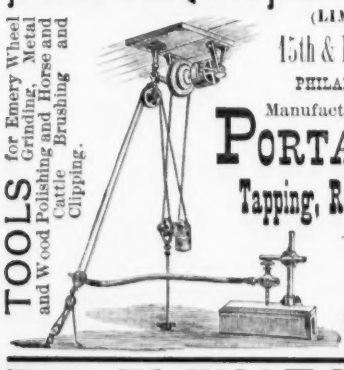

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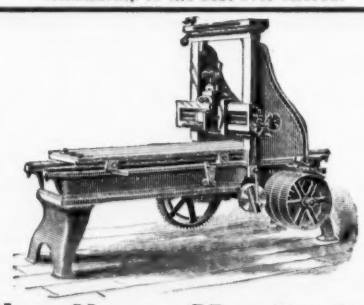

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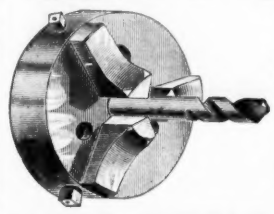

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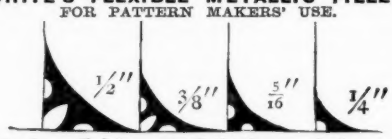

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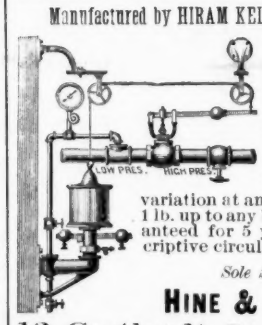

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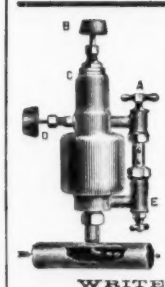

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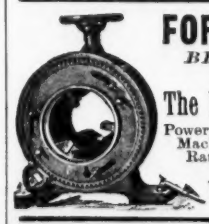

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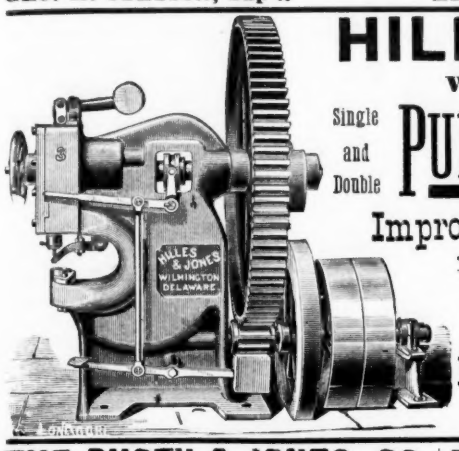

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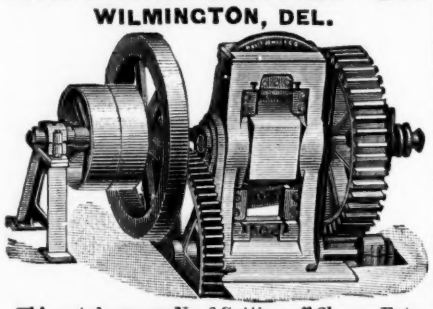

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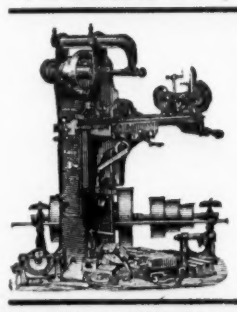

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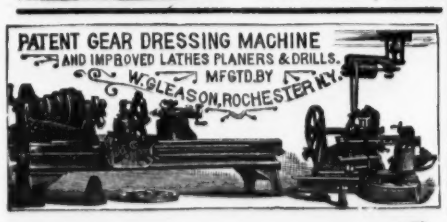

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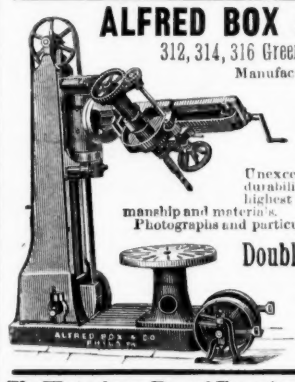

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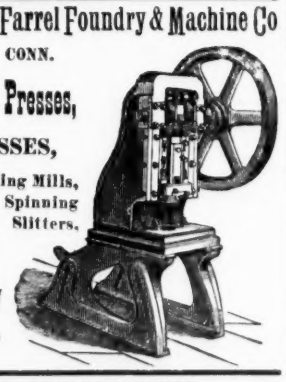

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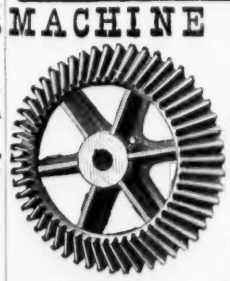

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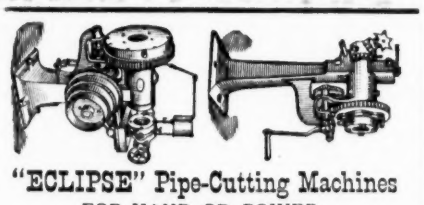

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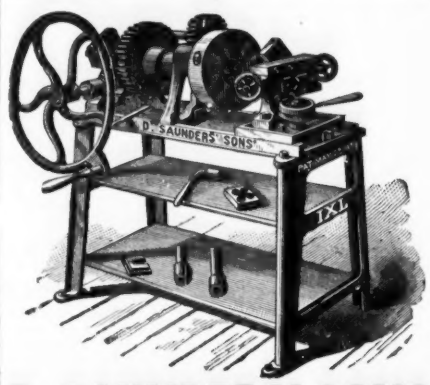

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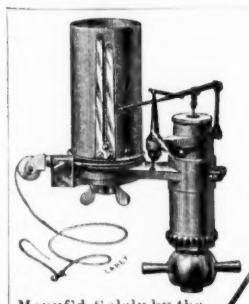

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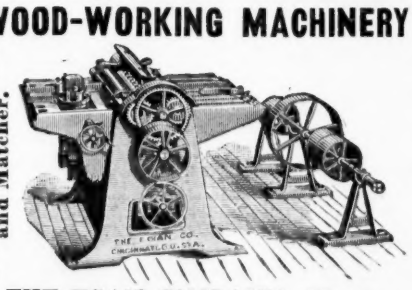

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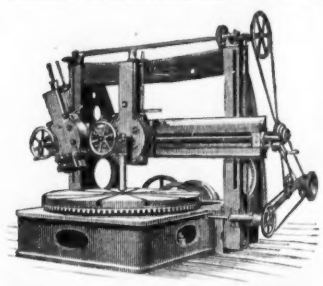

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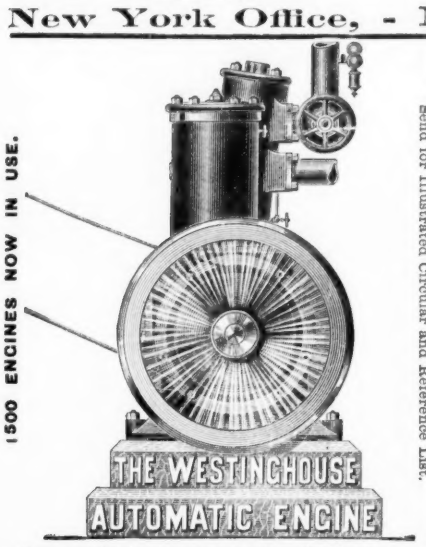

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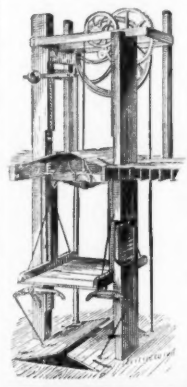

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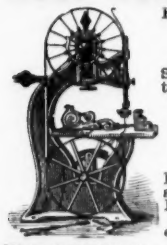

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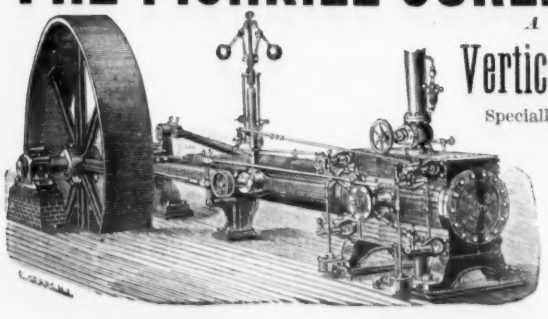

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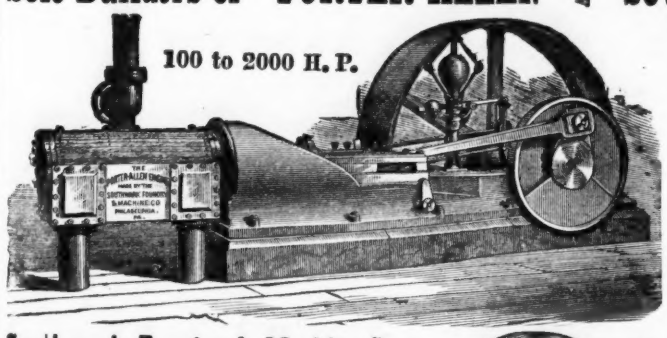

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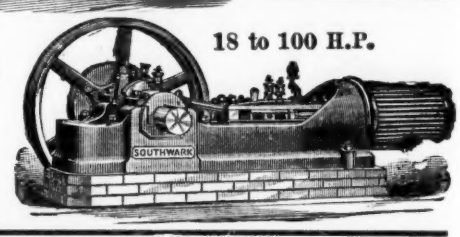

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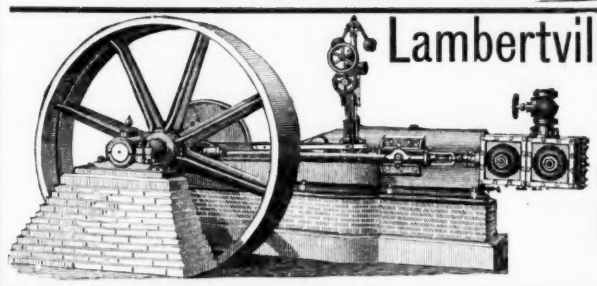

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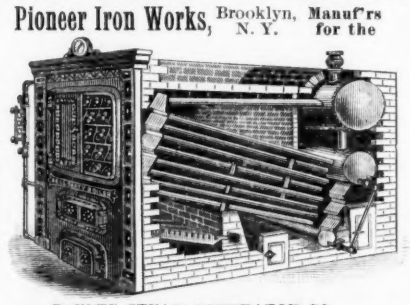

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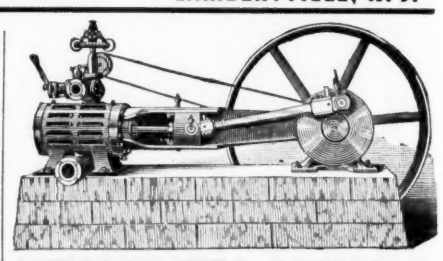

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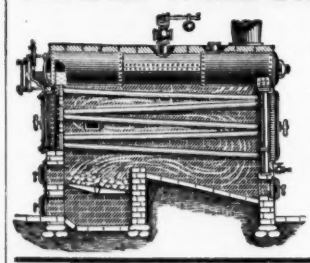

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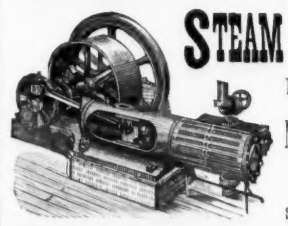

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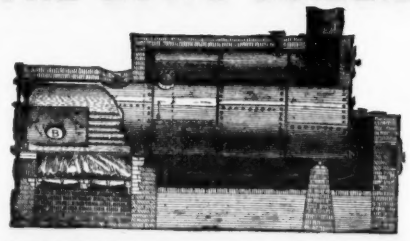

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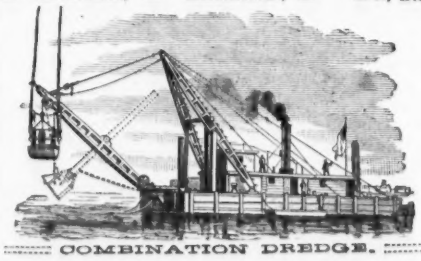

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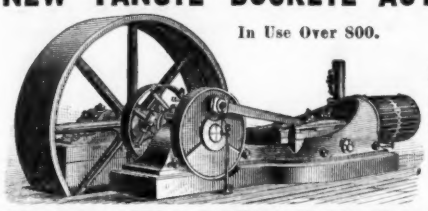

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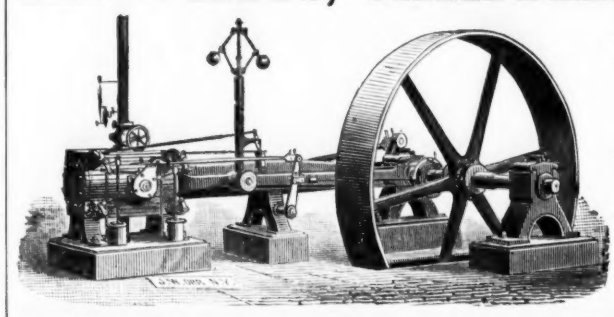

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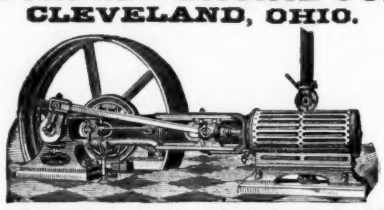

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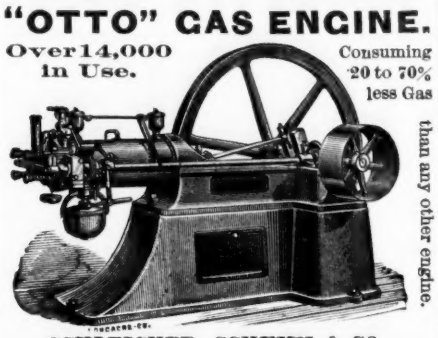

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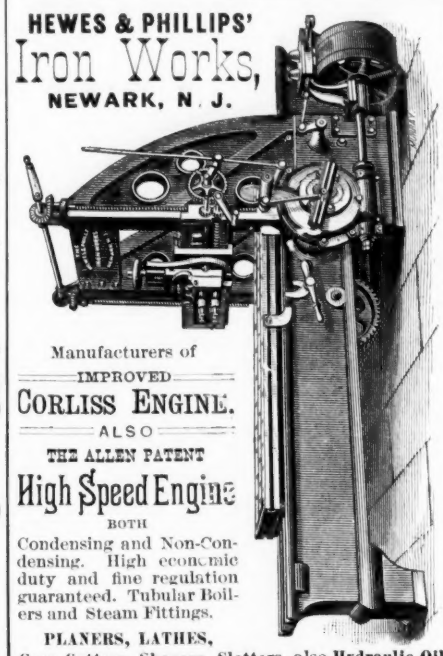

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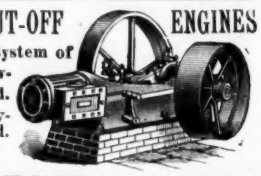

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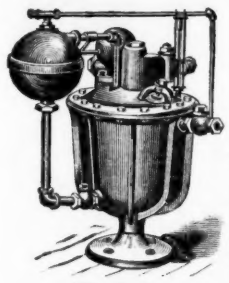

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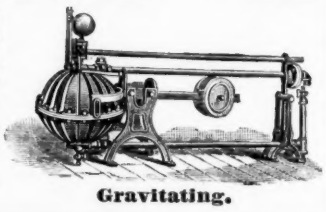

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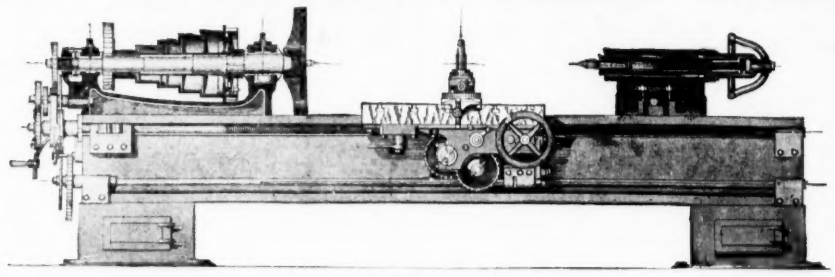

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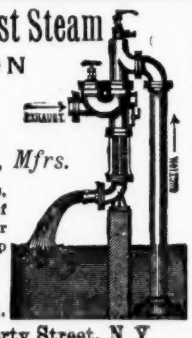

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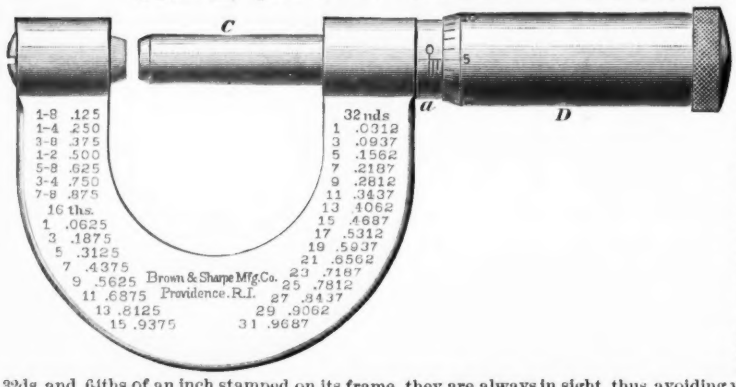

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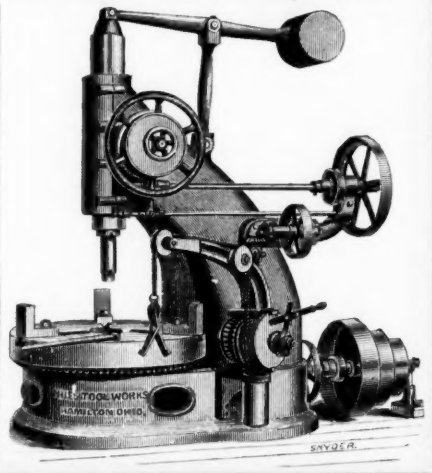

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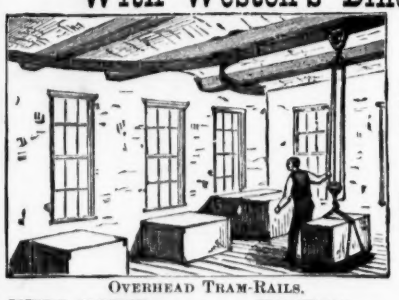

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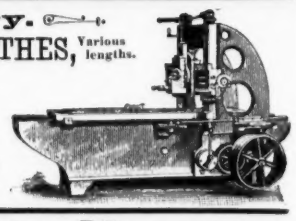

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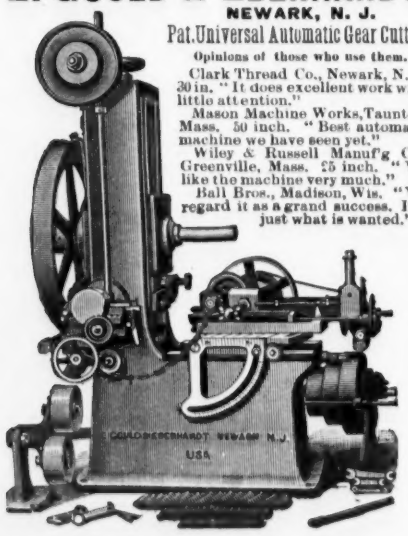

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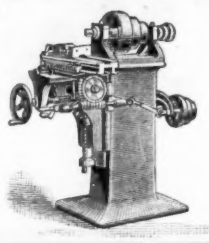

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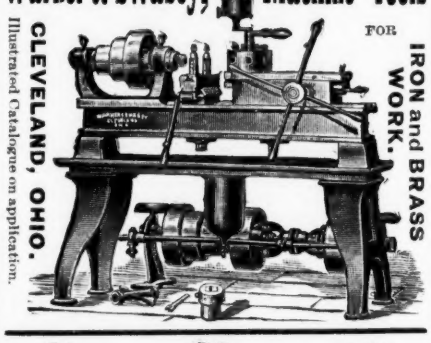

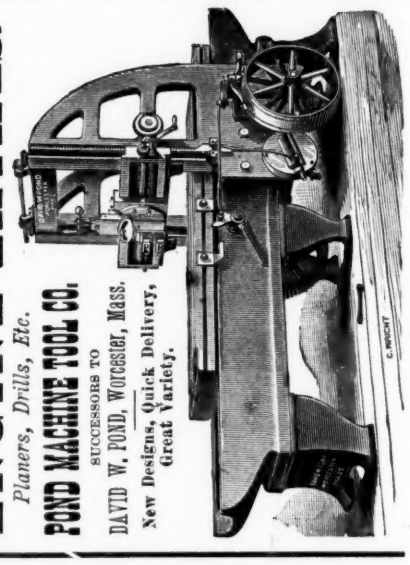

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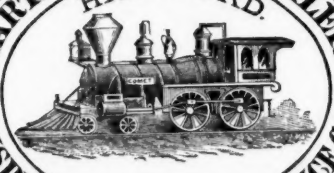

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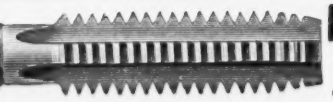

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